GAS

MARCH 1958

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Corrosion Prevention

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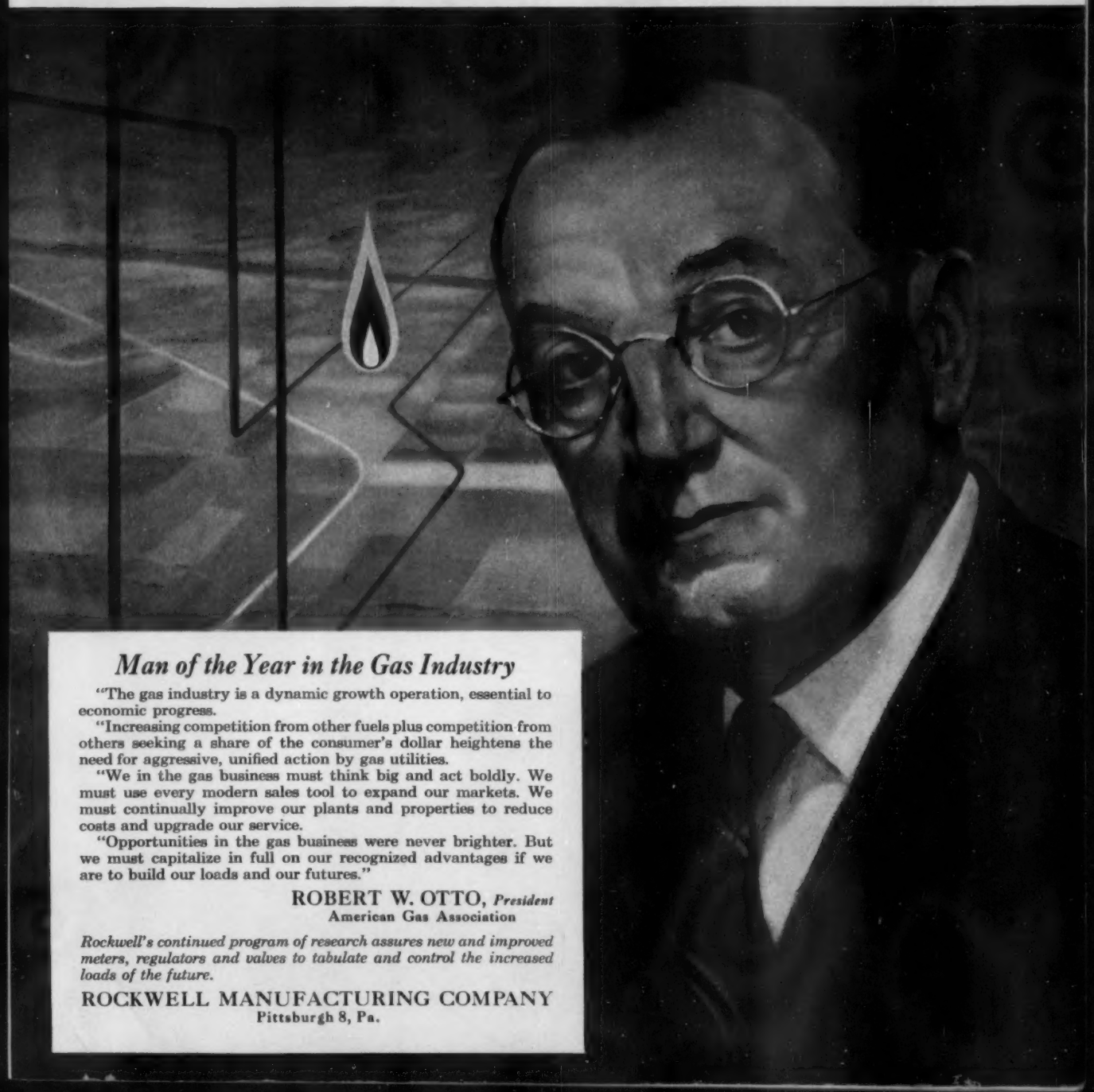

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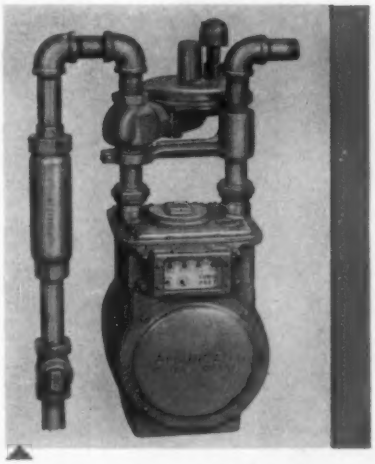

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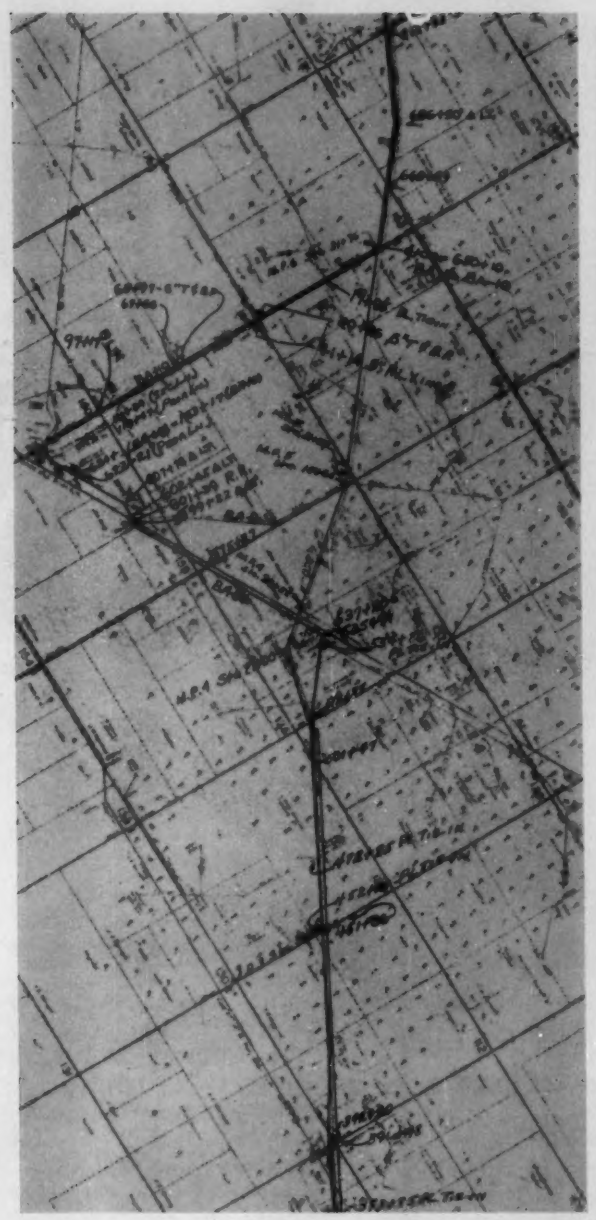

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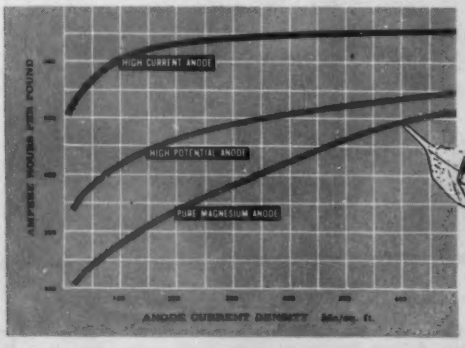

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CONTENTS

March 1958

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▪ FEATURES

Plastic Pipe and Corrosion Prevention Issue

1958—Another good year for plastic pipe 55
By Don Wright

Use of plastic tubing to replace services in low pressure system 59
By H. R. Murphy and T. R. Bogumill

Tubing used for drip pipe in submerged river crossing.... 64
By Thomas J. Lambeck

Louisville Gas uses plastic pipe to insulate services..... 67
By R. H. Walton

Long-term tests with various coating materials 69
By Hugo W. Wahlquist

Plastic-coated steel pipe being tested by utilities..... 75

A method to find shorts in a distribution system 77
By Thomas Snedden

What a serviceman should know about automatic top temperature control 82
By Charles E. Smith

Gray sees bright future for gas refrigerator 84
By Don Wright

Smokeless, odorless incinerators introduced 85

▪ PIPELINE SECTION

Plastic Pipe and Corrosion Prevention Issue

Cathodic protection of an old unprotected pipeline.....119
By David P. Price and Ray M. Wainwright

Corrosion measurement by resistance method 126
By D. M. Cloud

Asphalt mastic coating for offshore lines 132
By L. N. Brown

Editorial 142

Do it yourself pipelining 143

▪ DEPARTMENTS

Editorial Comment—

Thermally Thinking, *by J. Fred Ebdon* ... 6

Highlights 8

Regulatory and Legislative Trends 11

Technical Trends, *by Guy Corfield* 15

Washington, *by Neil Regeimbal* ... 17

Corrosion Prevention, *by Marshall E. Parker* 19

Communications, *by Frank Chapman* .. 153

News Developments—

Quebec starts conversion 86

Housewives need more facts on appliances... 87

Political explosions hit gas bill 144

Quicker action on Canada's gas export anticipated 144

Northern moves to get expansion under way.. 146

Departments

Calendar 94

Digest of New Products and Trade Literature. 96

People 102

Associations 110

Pipeline People 160

Advertisers Index 166

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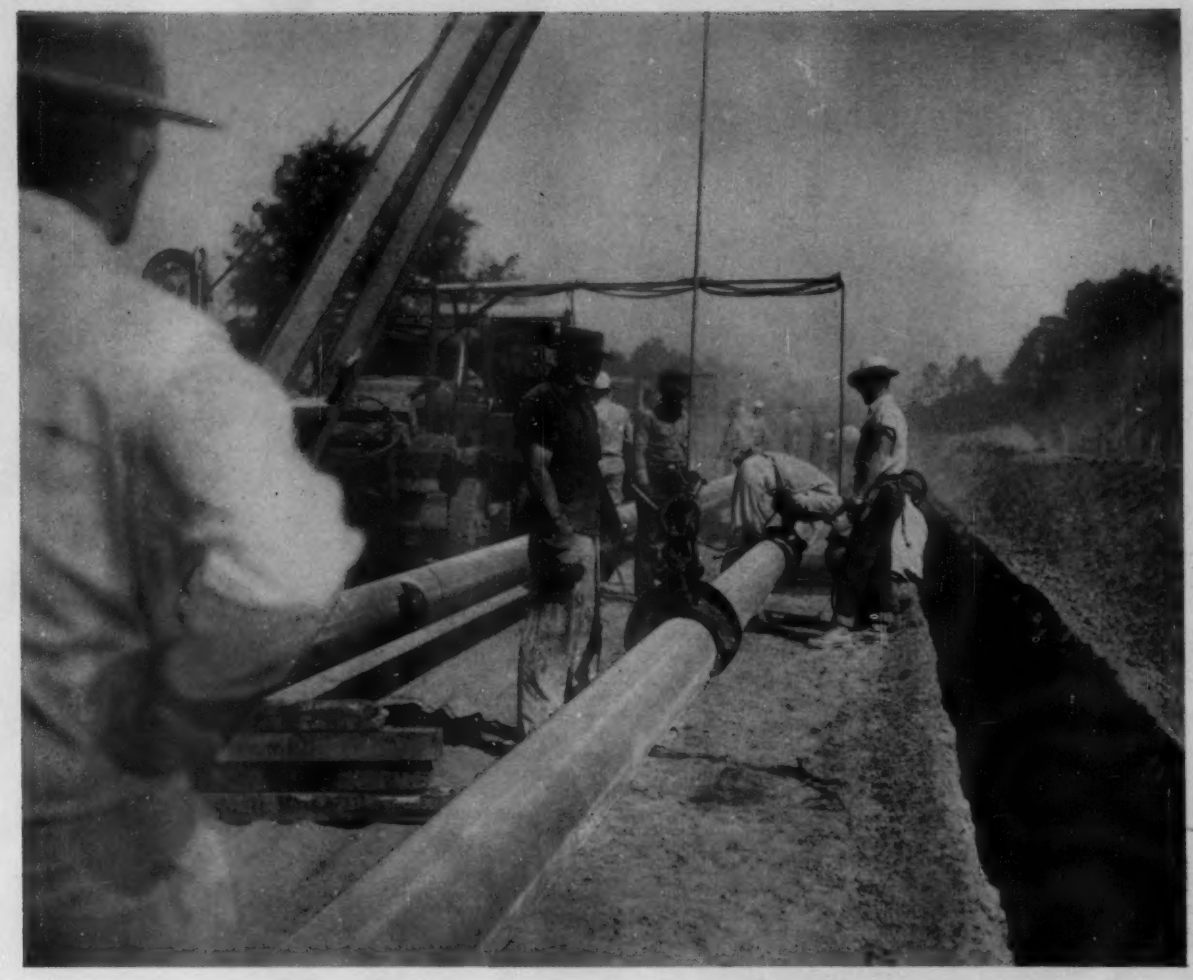

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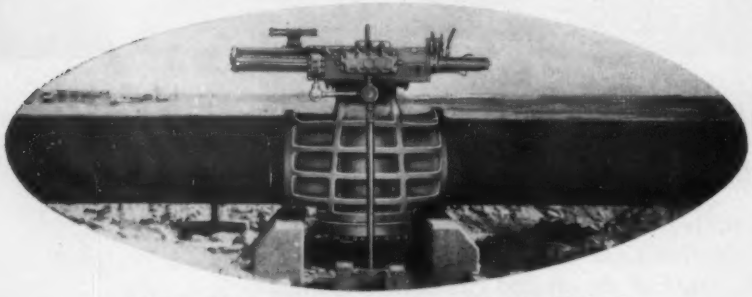

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GAS

MARCH 1958

Thermally Thinking

CORROSION engineers are very widely unsung. But, what a difference their science has brought to the gas industry. And did you ever stop to think of the responsibility they shoulder.

Corrosion engineers might better be styled corrosion prevention engineers, but we will have to string along with the conventional title. Their art is concentrated on the "care and feeding" of the gas industry's piping and other facilities—both above and below ground.

Let's take a look at our industry's piping—the prime target for the practice of corrosion engineering. There are over 546,000 miles of it. The vast majority is installed underground. It breaks down into 333,000 miles of distribution main; 153,000 miles of pipeline; and 50,000 miles of field and gathering line.

Now some of this is cast iron pipe, which resists corrosion excellently. And over 5.4 million ft of plastic pipe have been installed, which also is considered essentially corrosion resistant. But, much of this piping is steel or other metals that are subject to corrosion in varying degrees, depending on conditions. Some 11,603,000 tons of steel pipe have gone into the gas industry during the last eight years, alone.

The corrosion engineers and technicians are like a weight put on a balance. With their technology applied, the scale swings toward preservation of gas companies' property and investment. Without them, the balance would swing inevitably back to destruction and waste. Corrosion engineers with their basic tools—coatings and wrappings, and cathodic protection—are the barrier between one of the most destructive forces known on this earth and the enormous investment the gas industry has made in piping.

Most corrosion engineers I have known are pretty quiet people, tending toward shyness, except among themselves. Among themselves, they tend to agree on broad fronts, but are apt to disagree loudly and longly on details of theory and technique. To me, this is a mark of technical intellect today. To agree with all the details of technology and physical laws just because a lot of other engineers do, is a sign of the lack of an inquisitive mind. You will find open, searching minds among your company's corrosion engineers.

One oddity we have noticed about corrosion prevention people is that they never have a vehicle large enough for all of their equipment. We have observed them in the field with business coupes, sedans, panel trucks, etc., but in each case the vehicle involved is loaded to the point where one was reminded of Cox's Army, the Okie migration, or a gas company executive bringing his wife to the AGA convention in Atlantic City for the first time.

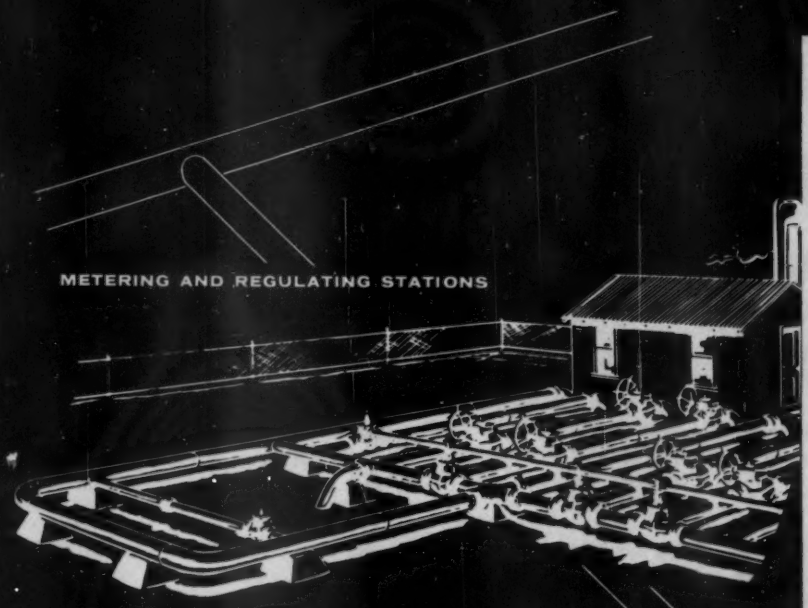
But, setting this idiosyncrasy aside, we salute the corrosion engineers and the National Association of Corrosion Engineers who will meet in smooth, sophisticated San Francisco later this month. These people do a real job for the gas industry. We wish them every success as they dash about with their copper sulphate reference electrodes, multi-combination meters and overloaded vehicles.

We should not forget the corrosion engineers' contribution and advancement in the science of mitigation of corrosive conditions in the gas industry. Our industry has given extensively to the technology of corrosion prevention; in turn, however, the industry has profited from this advancement of the art.

Perhaps there is a lesson to be learned here. We are not at all convinced that there has been too much investigation into the basic laws and principles that influence the production, transmission and distribution of gas.

J. Fred Ebsen

EDITOR



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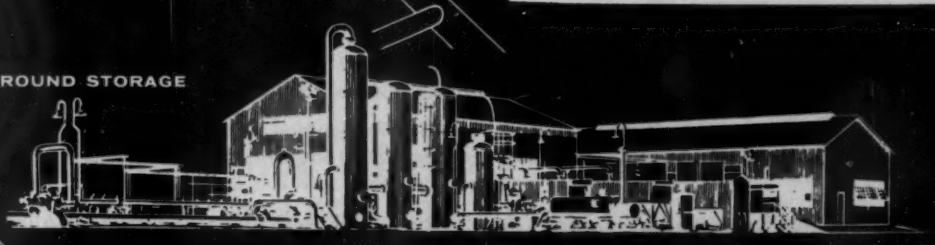

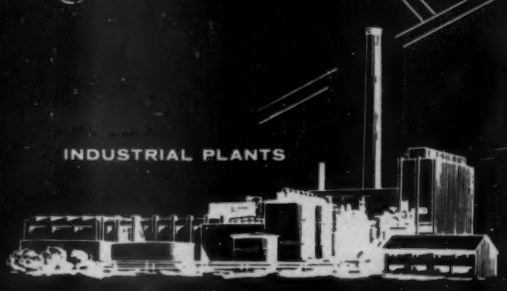

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GAS HIGHLIGHTS

Spokane Gas may merge with electric company

Spokane (Wash.) Natural Gas Co. may merge, and become part of a combination utility. If stockholders agree, it will merge into Washington Water Power Co., electric utility serving same area. Stockholders will vote in May on stock exchange, no cash deal. Gas company serves Spokane and Pullman, Wash., and Moscow, Idaho, and plans to build system in Couer d'Alene, Idaho.

Big deal brewing on Houston-Coastal line

Some kind of big deal due soon on Florida pipeline project. Best guess: three-way merger, with Houston Texas Gas & Oil Corp. and Coastal Transmission Corp. becoming operating subsidiaries of Houston Corp.

$200 million pipeline planned to California

A $200 million pipeline project is planned to bring more gas to southern California. Transwestern Pipeline Co. will build it to deliver 350 MMcf/day to Southern California and Southern Counties Gas companies. Pipeline principals are Warren Petroleum Co. (Tulsa), Monterey Oil Co. (Los Angeles), and J. B. Butler (Houston). Gas will come from reserves in San Juan and Paradox basins.

Canadians plan big gas promotion

Canadian Gas Association plans big consumer promotion this year. CGA, for first time in its 51 years, will push modernity, safety and economy of gas, and automatic features of gas appliances.

Trans-Canada line continues progress

Trans-Canada pipeline continues its progress. Alberta natural gas is now flowing in Lakehead cities of Fort William and Port Arthur. Completion is slated for this fall.

Electric firm seeks unusual rate scale

Texas electric utility is trying to set a rate schedule tying rates to cost of natural gas. Central Power & Light Co. (Corpus Christi) says proposed sliding rate wouldn't boost electric bills 'till 1960.

Central heating units drop in '57

GAMA says 1957 shipments of residential gas central heating units dropped 11.6 per cent over '56. Total of 1,095,800 were shipped.

Plastic pipe use will increase

Gas companies will use more plastic pipe in 1958. GAS' annual Plastic Pipe Survey shows 30 companies plan to use 727,990 ft this year, up 34 per cent over 1957. (For the details, see page 55.)

Gray sees better gas refrigerator

Better gas appliances will come from combination (electric-gas) manufacturers, says Whirlpool President Elisha Gray II. Reason: economies of tooling for dual line will permit more new models. Mr. Gray says newly acquired gas refrigerator line will benefit from this.

AGA demonstrates new air conditioner

AGA demonstrated its improved absorption gas air conditioner in San Antonio recently. Ten manufacturers were on hand. Unit was researched by Southwest Research Institute. AGA will retain patents, now is negotiating with possible manufacturers.

New gas package kitchen ready soon

New package kitchen will be unveiled by AGA next month. Designed by Walter Darwin Teague, it includes gas range, refrigerator, clothes dryer, incinerator, water heater, central heating, and possibly air conditioning.

FPC keeps defying Memphis decision

FPC continues to defy Memphis decision. Rate increases have been granted Texas Eastern and Algonquin Gas Transmission. Both companies must collect new rates under 100 per cent bond.

Canada may set gas policy soon

Canada may speed up its decision on export of natural gas. Premier Diefenbaker now says he expects the Borden Commission to file an interim report. This may clear the way for FPC approval of the Midwestern-TGT plan.

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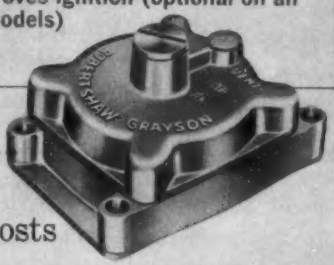

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Regulatory and Legislative Trends

A COMMENTARY ON NATIONAL AND STATE DEVELOPMENTS BY AN EXPERT IN UTILITY LAW

The Memphis decision

FOR 18 years the Federal Power Commission permitted gas rate increases to go into effect after a maximum of six months from the time the company filed the rate change. The Natural Gas Act makes it mandatory for the FPC to allow a filed rate increase after the suspension period if the case has not been decided in the meantime. Of course, the higher rates are subject to refund when the FPC completes its analysis of the evidence on revenues, operating expenses, depreciation, taxes, investment and return. FPC seldom authorizes the gas company's total rate increase and a partial refund is the general rule in the commission's final order. This Section 4 procedure under the Natural Gas Act has enabled gas companies to reduce the delay in obtaining rate relief to six months, while utilities under state regulation have waited more than a year for rate increase decisions. A gas company under FPC regulation has had an opportunity to remain financially strong by taking the initiative. This has been an important advantage that Congress provided to encourage the multi-million dollar, long-distance natural gas pipelines.

The recent decision by the United States Court of Appeals for the District of Columbia in the *Memphis* case crushed that FPC ratemaking procedure. Shouts of anguish were heard around the nation when that court declared that the contract between the buyer and seller must contain an agreement on the specific new rate before a Section 4 proceeding may be undertaken by FPC. Great financial damage will result if that decision is allowed to stand by the United States Supreme Court, because many millions in gas rate increases are pending before FPC and relying on the time honored procedure under Section 4. It is nearly unworkable to require that a buyer agree to a specific increase in the price he is to pay for gas. The customary gas contract today contains a consent by the buyer to permit the gas seller to seek a rate increase under Section 4, but reserves the right to the buyer to protest. This gives a gas company the means for keeping its earnings up to a fair return level, and also permits the buyer to object to any unreasonable price increase before FPC fixes the final price.

• The court's startling decision

The court reversed FPC and directed that the money collected by the selling pipeline company be refunded to the customers. The court stated: "We hold that since United had not obtained the consent of its contract customers to the rate itself—albeit some of those customers may have consented to the act of filing—the Federal Power Commission had no power to file the new rate schedules under Section 4 (d) and therefore could not review the new rate pursuant to Section 4 (e). It is not sufficient for a Section 4 (d) filing that United's customers have consented to allow United to have the commission invoke Section 4 (e) to review a rate increase during the contract term, where the parties have not agreed to the specific rate."

• The FPC's reaction

The Supreme Court of the United States has consented to review the Court of Appeal's *Memphis* decision after the FPC so petitioned the Solicitor General. Chairman Kuykendall feels the case is one of major importance, because it requires such radical adjustment of the rate procedure from that which was considered to be provided by the National Gas Act. The chairman concluded that "In the commission's opinion, the effect of the decision will be adverse to consumers, because the financial stability of many pipeline companies may be impaired or destroyed, thus hampering or perhaps terminating existing service and preventing continued and necessary expansion of the industry."

Unless the Supreme Court reverses the lower court's *Memphis* decision, or Congress enacts remedial legislation, the financial fallout from this atomic blast will injure all members of the $20 billion gas industry.

• The reasons given by the court

Judge Washington, who had Judges Bazelon and Bastian with

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Regulatory trends . . . Memphis case is based on Court's Mobile decision

him on the case, wrote the opinion of the court. He stated that the *Memphis* case concerns the interpretation to be given the Supreme Court's decision in the *Mobile* case. In that 1956 decision the Supreme Court ruled that a gas seller could not unilaterally increase its contract rates to a gas purchaser.

The contract involved in the *Memphis* case provided that, "All gas delivered hereunder shall be paid for by Buyer under Seller's Rate Schedule ———, or any effective superseding rate schedules, on file with the Federal Power Commission." Judge Washington asserted that the question is whether the contract clause just quoted provides the consent necessary to give the FPC jurisdiction to review under Section 4 of the Natural Gas Act the gas company's filed rate increase.

The FPC found that the phrase "any effective superseding rate schedules" did provide the consent required by the Supreme Court's *Mobile* decision. FPC said that it was the intent of the contracting parties to grant the pipeline the power to make changes in rates under Section 4. FPC stated that it was understood also that gas purchasers had the right to oppose the rate change in proceedings before the commission for the purpose of testing the justness of the new rate. FPC ruled that the gas pipeline's proposal for increased rates was not a prohibited unilateral change of a contract.

Judge Washington declared that, in effect, FPC's position is that the contractual consent to the act of filing a new rate is sufficient. The court added that three of the pipeline company's customers had not consented to the amount of the new rate, because they opposed the rate increase before FPC. In reversing FPC, the court gave several reasons.

The Court of Appeals announced that the notice of a change in a contract for the sale of gas, contemplated by Section 4 of the Act, is notice that the seller has offered and the buyer has agreed to a new price. The court said that it is only at this point—after parties have negotiated privately a new price—that FPC becomes involved in the Section 4 ratemaking process. Nothing in the statute gives FPC authority to assist the seller and buyer in negotiating a new rate, declared Judge Washington.

For FPC to review gas rates under the expeditious procedure of Section 4, the seller must bring an agreed rate. The new rate must be as specific in its terms as was the previous agreement to the rate schedule sought to be superseded, said the judge. He continued by observing that the agreed new rate may then be reviewed by FPC, which can approve, modify or disallow it. To the extent that the new higher price is found to be unreasonable by FPC, appropriate refunds will be ordered.

Judge Washington then quoted the Supreme Court's opinion in the *Mobile* case to support his conclusion. In *Mobile* it was stated that Section 4 of the Natural Gas Act does not establish a rate-changing procedure, but provides for filing a notice to FPC of rate changes. The change is effected by the natural gas company's own action and not by an FPC order. If the change in the price of gas is one which the natural gas company has the power to make, the change is completed upon compliance with the notice requirement, said the Supreme Court. The new rate has the same force as any other rate, and it can be set aside only upon a finding by FPC that it is unjust and therefore unlawful.

The Supreme Court was again quoted by Judge Washington to establish that FPC has not been given the authority to arbitrate a dispute when a seller of gas seeks to raise the price. In the *Mobile* quotation, the highest court in the land asserted that Section 4 rates and Section 5 prospective rates after decision by FPC are parts of a single plan. Under that plan all gas rates are established initially by natural gas companies, by contract or otherwise, and all rates are subject to modification by FPC. The Natural Gas Act defines the review powers of FPC and imposes duties on gas companies as are necessary to effectuate those powers. The Act neither grants nor defines the initial rate fixing powers of natural gas companies.

The Supreme Court commented on the basic power of FPC to set aside or modify any rate which it determines, after a fair hearing, to be unreasonable or unduly discriminatory. This is neither a ratemaking nor a rate-changing procedure. It is, said the Court, "simply the power to review rates and contracts made in the first instance by natural gas companies and, if they are determined to be unlawful, to remedy them. Section 5 (a) would of its own force apply to all the rates of a natural gas company, whether long-established or newly changed, but in the latter case the power is further implemented by Section 4 (e). All Section 4 (e) does, however, is to add to this basic power, in the case of a newly changed rate of contract (except industrial rates), the further powers (1) to preserve the status quo pending review of the new rate by suspending its operation for a limited period, and (2) thereafter to make its order retroactive, by means of the refund procedure, to the date the change became effective. The scope and purpose of the commission's review remain the same—to determine whether the rate fixed by the natural gas company is lawful."

Judge Washington of the Court of Appeals in the *Memphis* case followed the quotation just made from the Supreme Court's *Mobile* decision with a reference to authority delegated by Congress. He stated that "The contracting parties cannot, of course, vest the Federal Power Commission with power not given to that body by Congress."

The Court of Appeals in the *Memphis* case was wrong. The United States Supreme Court should reverse the lower court, and let us hope it happens in 1958, so that financial chaos will not result for the gas companies involved. ■

Built to "take it," this low-cost Barber-Greene Ditcher cuts the cost of digging narrow trenches . . . proves that hand digging is no longer economical, even on the smallest jobs.

Digging from house to main at less cost than ever before

When laying pipe for service lines and other installations, utilities and contractors have had to contend with the high cost of digging and backfilling the required trenches.

The new Barber-Greene 702 Ditcher has solved this problem. Despite its small size, the 702 is the newest machine in the most rugged line of ditchers made.

Prior to this new development, available machines either dug too wide for practical and economical operation, or did not have the stamina and digability required for coping with unfavorable conditions.

Utilities, contractors and railroads are now gaining the advantages of underground lines and services in virtually every area of the country.

Applications, to date, include electric power and telephone lines and house services, railroad signal systems, traffic control systems, outdoor theater wiring, installations of small gas and water lines and services, lawn sprinkling systems and others.

Digs to 40" deep, 5" wide. The 702 can be easily towed or carried on a light truck. Simple-to-operate dual controls permit operation from seat or from side of machine for full view of trench.

Write for literature on this important, new, low-cost ditcher 56-30-D

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

TECHNICAL TRENDS

By GUY CORFIELD

Always something new in plastics

It must be stimulating, but also sometimes frustrating, to be a plastics engineer. It seems that new plastic materials and products are continually appearing, often before the technology and use of earlier materials are fully developed. The gas industry of course has a definite interest in these new materials as they may be applicable to gas piping and approach metals in construction and performance characteristics.

One of the oldest and best known and most widely used of the plastics is polyethylene. It might be regarded as a standard plastic material. It underwent some modification recently by development of the low pressure process (see the item headed "Low Pressure Polyethylene" on the November 1957 issue of this page), but the total production of both the former and modified types was expected to approach 1 billion lb per year. It is now reported that *polypropylene* will rapidly become a rival to polyethylene and "capture a big slice of the total plastics market." It is already in commercial production in Europe and will soon be produced also by several large firms in the U. S. Polypropylene is said to have a wider range of desirable characteristics than any other single plastic so far developed. Its specific gravity is less than that of polyethylene, giving it a weight-volume advantage.

Another new plastic is General Electric's "Lexan." It is described as "tough as nails" and is actually used in the form of nails to drive into timber (instead of iron spikes) so that the timber can subsequently be cut without possible damage to saw teeth. Its physical strength, plus almost complete resistance to dimensional change and other deterioration from water or petroleum oils, make it promising for machine parts, pump gears, etc. It also will not deform at temperatures up to 140°C (284°F). In these respects it is said to be much superior to nylon.

Air infiltration in houses

All houses and similar structures are subject to some degree of natural ventilation, usually termed infiltration. It occurs as air movement through the house and its extent is expressed in air changes per hour. Actually there is infiltration at one part of the house and a corresponding volume of exfiltration at some other part. This movement of air is through window and door cracks, and miscellaneous small unintentional and unrealized structural openings; also, sometimes, even through the apparently solid areas of walls, floors and ceilings. The forces causing this air movement are: (1) wind blowing against the house, (2) indoor-outdoor temperature differentials and the related action of chimneys and flues even though a fire or appliance is not burning, (3) temperature differential within a room or between basement and floors and attic space, and (4) fan-forced movement of inside air, etc.

Infiltration rates of one air change per hour or greater are not uncommon in temperate climate housing where weather stripping and storm windows and generally tight construction are not used. Under the most favorable conditions of careful construction and lack of wind, there is practically always infiltration of at least one-tenth air change per hour. Extreme building precautions, and covering of windows and doors, is required to make a room or house perfectly "tight."

This phenomenon is of interest to the gas industry, both from a house heating or cooling standpoint, and when analyzing a gas leakage problem. Excessive infiltration can add considerably to the heating or cooling requirements of a structure, as can be realized when the temperature difference between entering and exiting air is considered. When gas leakage has occurred in a house, or when an accident is of such a nature that gas leakage may have been the cause, a study of the related effects of air change can often be quite helpful. The air leaving the room or house must carry with it some of the leaking gas. It is therefore possible to calculate what the amount of gas leakage must have been to allow a build-up of gas sufficient to cause the accident; or it can be calculated in some instances that an asserted rate of gas leakage could not have built up the concentration to the amount necessary to promote the accident. Therefore the accident must have been caused by something else, or by a deliberate release of gas in excess of the asserted leakage rate. It is usually difficult to conceive, for instance, how pilot or low-input burner volume of gas could cause a significant gas concentration to build up in even a relatively small enclosed space.

One of the most accurate means of measuring infiltration in a house is to add to the air a gas, the concentration of which can be measured, and observe its rate of disappearance. In the June and July 1957 issues of *Heating, Piping and Air Conditioning* are parts I and II of an article entitled "Measurement of Infiltration in Two Residences." This measurement was made by the use of helium as the "tracer" gas. One residence was two-story and the other one-story. Numerous variables were studied and evaluated. This two-part article, and the bibliography, will be very informative to anyone wishing to explore this subject or conduct tests.

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WASHINGTON

By NEIL REGEIMBAL
GAS Washington Bureau

Wanted: Solutions to three major problems

THE gas industry is back in Washington. In force. And it faces some of the most difficult battles yet in the long war over federal control.

Big and little knots of gas industry lawyers have been busily meeting under the shadow of the Capitol and the White House for some weeks now drafting new legislation and amendments, redrafting them, and negotiating compromises with each other, with other industries and with their opponents.

Lobbying as such—a dirty word in the industry—has reportedly been almost nonexistent.

The independent producers and the pipelines, with distributors keeping close watch, have been attacking three major problems: The gas bill, the Memphis decision, and the Kansas state minimum price law. They've also been keeping an eye on moves in Congress to pare gas and oil depletion rates, and on the Federal Power Commission, which has been studying all existing producer rate schedules on file at the agency.

First problem was the gas bill. Trading on this measure to make federal controls more palatable to gas producers was hot, heavy, and complicated as the measure neared a show-down vote in the House. The bill's fate rested squarely on how well the compromisers accomplished their horse-trading.

Lurking in the shadows always was the possibility of another Presidential veto if the bill didn't match White House political requirements. Another veto, the third for a gas bill, would probably be the death knell for such legislation.

Pivot around which the major gas bill power plays were being run was the so-called coal amendment to give the FPC control over direct pipelines sales to industrial customers. The coal industry last fall had approached the gas industry on the possibility of turning its previous opposition into needed support in trade for this amendment. Pipelines balked, but producers believed they needed the votes this year.

By January, when the real serious drafting began, the amendment had been watered down so that it would in effect prevent "dump" sales of gas in off-peak seasons. Many pipelines still didn't want it, but the White House did. Word went out from the President's top aides to congressional sponsors of the Harris-O'Hara gas bill that coal interests must be "protected" by some kind of anti-dumping amendment.

Congressional cloakroom talk reported an unusual coalition formed between a group of gas bill backers and the coal operators. The gas interests agreed to support an amendment to the foreign trade act this year restricting imports of crude oil in exchange for coal industry support for the gas bill with a coal amendment included.

Drafters of the coal-backed amendment in the gas bill were convinced that they would have to come up with a proposal, even though a compromise, which had at least what the White House would buy as "basic protection" for the coal producers, or the death-dealing veto might be brought out again. Fancy words or phrases wouldn't do the trick, they believed.

Ike's interest in the coal amendment was mainly in getting more democratic votes behind the gas bill, to make it a bipartisan measure and take it out of politics as much as possible.

Despite the horse-trading, compromising, and juggling, the bill's backers in the House figured passage at best by a handful of votes. They planned to put it on the line by mid-March, at the latest.

Backers of the bill also were casting worried second glances at the Senate should the bill squeeze through the House. Earlier predictions that it would have clear sailing through the upper house were withdrawn in favor of "cautious optimism." While the outlook was better than in the House, a close vote was forecast in the Senate too.

The bill's backers also knew the coal amendment would add fuel to the opposing fires. Cries of an "unholy alliance," and "conspiracy" between gas and coal, competing fuels, were certain to be raised by so-called consumer groups, and reflect on the entire industry.

Although basic, the gas bill is far from the only worry of the gas producers and pipelines. (Some insiders say they now understand the problems of the mythical character who slid backward two steps each time he took a step forward.)

The legal strategists for the gas industry have a second major problem to figure out in the next few weeks—the Memphis decision.

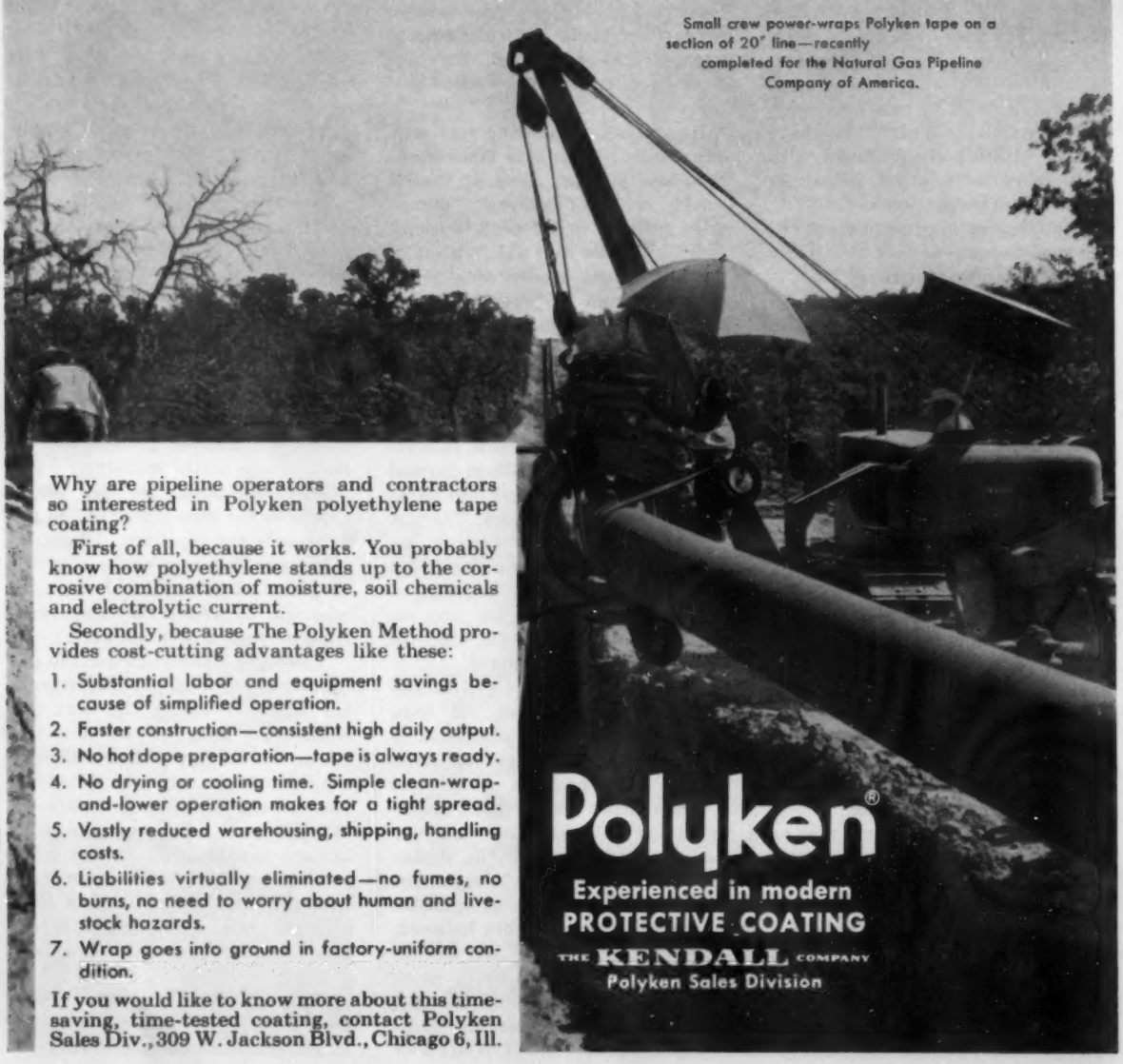
The government has officially sought a U. S. Supreme Court review of the decision, in which an appeals court held that the FPC cannot consider an unscheduled pipeline rate rise unless the consent of all its customers had been secured. But a hearing and decision before next fall or winter is highly unlikely.

Congress, therefore, is the best

Continued on page 92

Big-Inch pipeline wrapped the modern way

Polyken Tape saves time, labor and handling costs, yet resists corrosive attack as only polyethylene can



Small crew power-wraps Polyken tape on a section of 20" line—recently completed for the Natural Gas Pipeline Company of America.

Why are pipeline operators and contractors so interested in Polyken polyethylene tape coating?

First of all, because it works. You probably know how polyethylene stands up to the corrosive combination of moisture, soil chemicals and electrolytic current.

Secondly, because The Polyken Method provides cost-cutting advantages like these:

1. Substantial labor and equipment savings because of simplified operation.
2. Faster construction—consistent high daily output.
3. No hot dope preparation—tape is always ready.
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5. Vastly reduced warehousing, shipping, handling costs.
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7. Wrap goes into ground in factory-uniform condition.

If you would like to know more about this time-saving, time-tested coating, contact Polyken Sales Div., 309 W. Jackson Blvd., Chicago 6, Ill.

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Polyken Sales Division

Edited By MARSHALL E. PARKER

A look at today's asphalt pipe enamels

By Lloyd F. Bramble, president,
Gulf States Asphalt Co.,
South Houston, Texas

ENGINEERING specific qualities into a base material is usually of interest only to laboratory and field technicians involved.

The readers of *GAS*, however, may be interested and perhaps informed by an article detailing the various tests and measurements routinely run by leading asphalt specialty firms on their production of quality pipe enamels, to insure uniformly high performance in the ditch.

Our own fundamental research and development efforts began many years ago. A comprehensive analysis of all existing types of basic asphalt compounds and basic asphalt crudes, both in the States and foreign countries, was undertaken. Where asphaltic residuals, as such, were not available, we obtained crudes and by distillation and reduction subsequently arrived at asphalt residuals. It was a staggeringly ambitious, complex undertaking.

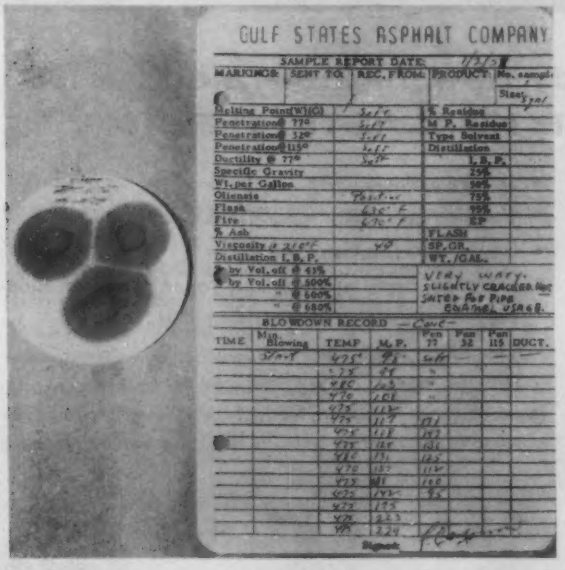
First it was necessary to determine whether basic crudes were separated prior to refining processes. Generally small refineries handle certain specific crudes in their daily operation. Thus, it became quite simple to determine whether Refiner A's product is inferior or superior to Refiner B's product.

Complexity was multiplied sharply when we surveyed large refineries which frequently handle mixed crudes from several fields. These difficulties were overcome in due time.

On the whole, refining operations are extremely accurate, varying slightly from day to day and year to year. It is a literal fact that we have purchased and used residuals from large major refineries which are absolutely identical to residuals purchased 10 years or more ago. While advancements have been made in refining processes during this time, such improvements in the refining technique have not resulted in appreciable changes in asphaltic residuals when vacuum-treated.

These uniformity controls in asphaltic pipe enamels are notable because no such uniformity is possible with other pipe enamels. Such residual materials are largely accepted in the manner in which they are received.

(*Continued on page* 115)


GULF STATES ASPHALT COMPANY

SAMPLE REPORT DATE: 1/3/58

MARKINGS	SENT TO	REC. FROM	PRODUCT	No. samples
				Sizes

Melting Point(W&G)	Soft	% Residue	
Penetration @ 77°	Soft	M.P. Residue	
Penetration @ 32°	Soft	Type Solvent	
Penetration @ 115°	Soft	Distillation	
Ductility @ 77°	Soft	I. B. P.	
Specific Gravity		25%	
Wt. per Gallon		50%	
Oliensis	Positive	75%	
Flash	630° F	90%	
Fire	670° F	EP	
% Ash		FLASH	
Viscosity @ 210° F	49	SP. GR.	
Distillation I. B. P.		WT./GAL.	
% by Vol. off @ 43%		VERY WAXY. SLIGHTLY CRACKED. Not suited for Pipe Coating. USAGE.	
" @ 500%			
" @ 650%			

BLOWDOWN RECORD — Coal

TIME	Min. Blowing	TEMP	M. P.	Pen 77	Pen 32	Pen 115	DUCT.
	Start	475°	98°	Soft			
		475	98	"			
		480	100	"			
		470	101	"			
		475	114				
		475	117	171			
		475	118	142			
		475	118	103			
		470	120	123			
		470	122	114			
		472	121	108			
		475	124	84			
		472	119				
		470	223				
		470	122½	Coke			

Signed: [illegible]

Physical characteristics of basic asphalt compounds are here summarized on these laboratory slips, together with a spot test of the material. Sample on left revealed undesirable qualities, summarized with notation "Very waxy. Not suited for pipe enamel—

GULF STATES ASPHALT COMPANY

SAMPLE REPORT DATE: 1-10-58

MARKINGS	SENT TO	REC. FROM	PRODUCT	No. samples
				Sizes

Melting Point(W&G)	134	% Residue	
Penetration @ 77°	25	M.P. Residue	
Penetration @ 32°	20	Type Solvent	
Penetration @ 115°	125+	Distillation	
Ductility @ 77°	110+	I. B. P.	
Specific Gravity	1.027	25%	
Wt. per Gallon	8.55	50%	
Oliensis	Negative	75%	
Flash	640° F	90%	
Fire	690° F	EP	
% Ash		FLASH	
Viscosity @ 210° F	120	SP. GR.	
Distillation I. B. P.		WT./GAL.	
% by Vol. off @ 43%		DUCTILITY SPECIFICATIONS, Stain factor, very good. Surface appearance excellent.	
" @ 500%			
" @ 650%			

BLOWDOWN RECORD

TIME	Min. Blowing	TEMP	M. P.	Pen 77	Pen 32	Pen 115	DUCT.
	Start	475	124	51	20	22+	110+
	5	480	124	38	18	Pass	110+
	10	485	131	40	19	28+	110+
	15	485	132	34	17	26+	110+
	20	478	136	34	17+	140+	85+
	25	475	143	31	17+	105+	38+
	30	475	149	26	11	78	16+
	40	480	154	20	10	76	8.5
	50	480	162	15	10	68	6.5
	70	485	181	15	9	54	4.5
	85	485	192	13	8	52	3.5
	100	485	195	12	7	50	3.2
	120	475	230	10	8	19	—

Signed: [illegible]

slightly cracked." Note the difference in the discs in the photo at right. Notation reads "Ductility excellent. Stain factor very good. Surface appearance excellent."

Naugatuck KRALASTIC

Extruders make ready new, higher-rated lines of IPS and SWP KRALASTIC PIPE

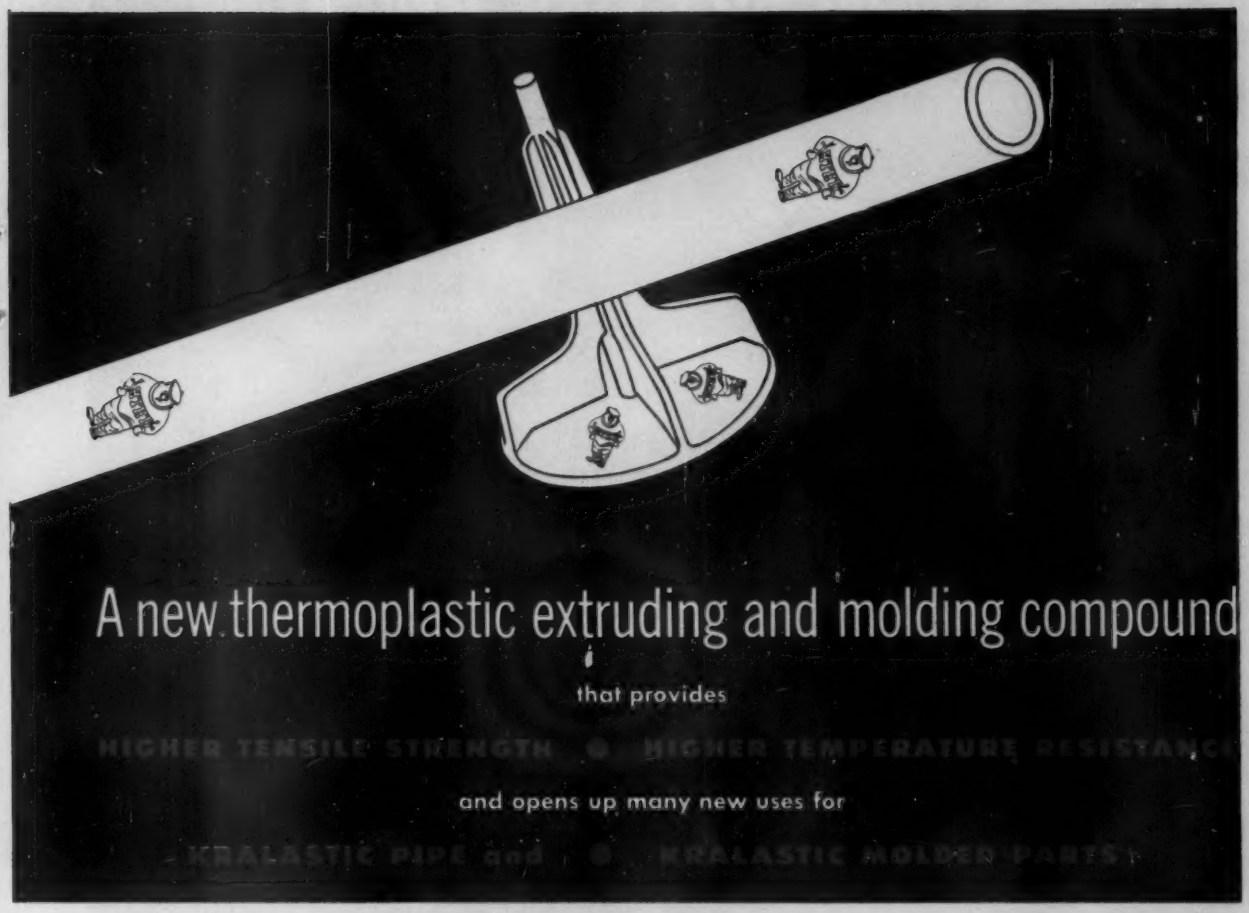
Because of its proved durability, toughness, flexibility, chemical resistance, light weight and speed of installation, pipe made of Kralastic® has earned a unique position in the field of thermoplastic pipe.

This is evident from the more than 7,000 miles of Kralastic pipe now installed for such uses as:

- Carrying natural gas
- Gathering lines, flow lines and salt-water disposal lines in the oil fields
- Jet well piping
- Transporting potable water (N.S.F.-approved)
- Underground sprinkler systems
- Handling corrosive liquids in paper, chemical, food-processing and water-treatment plants
- Conduit for electrical wiring

Not content with having produced the *best* pipe-extruding compound of its kind, Naugatuck's research and development chemists have been at work for some time on a

Look for "The Champ" symbol at dealers selling pipe made of Kralastic HTHT... and eventually on the pipe itself.



compound having even higher tensile strength and capable of withstanding higher temperatures without distortion. Kralastic HTHT is the result.

Extensive new facilities for the production of Kralastic HTHT are now being completed. Meanwhile, limited quantities of the compound have been released to Kralastic extruders who have planned a new range of IPS and SWP sizes and ratings of pipe and fittings to take advantage of its greatly improved strength and temperature properties. These new lines of pipe make it possible for many new users to enjoy the economies and durability of Kralastic pipe in still more fields of application.

These advantages can be yours if you make certain that the plastic pipe you buy for high-pressure or high-temperature service is made of Kralastic HTHT. It's your assurance of satisfaction.

If you would like a list of pipe manufacturers using Kralastic HTHT...or if you are interested in its possibilities for your own production of extruded products or molded machine parts, write us today.

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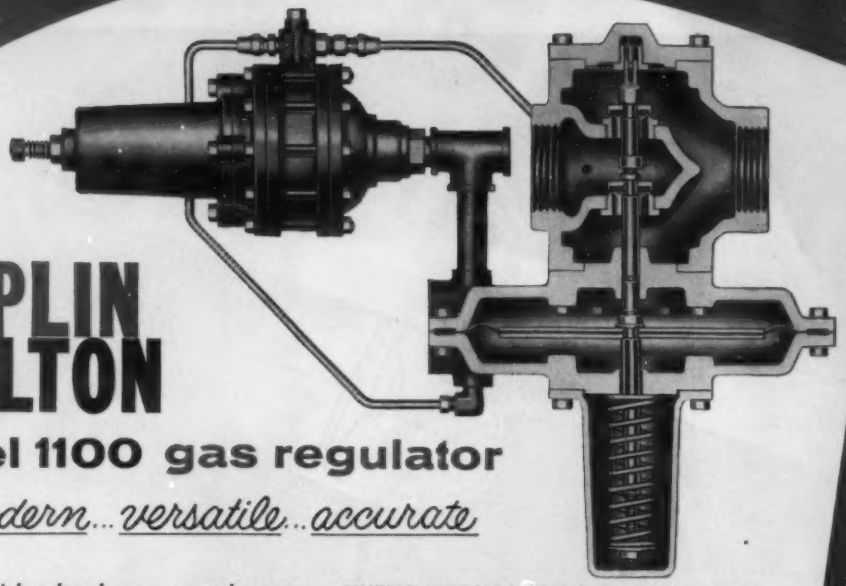

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You can't buy, beg, borrow or steal a more versatile pressure regulator than MODEL 1100. Nor has traditional Chaplin-Fulton ruggedness, simplicity or accuracy been forgotten in this new modern design. Size —2" only, screwed, flanged 125 or 250 ASA.

WIDER APPLICATION Inlet Max.—400 psi. Outlet Range—1" to 150 psi.

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SIMPLER INSTALLATION Only one connection required. No complicated pins or toggles to adjust.

You can standardize on MODEL 1100 for a wider range of your industrial, commercial or distribution installations.

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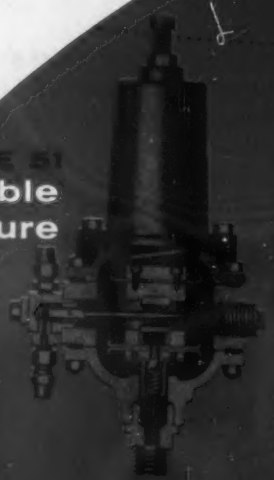

TYPE 51
variable
pressure
pilot

The heart of the MODEL 1100 assembly, insuring precisely accurate control over the complete flow range.

- Unitized construction—valve lever and orifice as a unit are removed from the outside, without disturbing balance of assembly. The likely trouble spot—the orifice—is placed outside where you can get at it quickly—no internal tubes to clog.
- Twin diaphragms remove as a unit.
- Internal relief unit—guards against overpressure.
- Spring unit—remove these screws to change springs.
- Built for service.
- Used for accuracy.

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AUTOMATIC RECYCLING MANUAL OPENER (optional)

SERIES "SLS" SAFETY REGULATOR WITH 100% SHUTOFF IN CONJUNCTION WITH QUIET AUTOMATIC MAIN GAS VALVE

SLS 101—½"
SLS 201—¾"

This control with Independent Safety Shutoff Valve (not a Safety Solenoid Switch in series) assures safe use (even when equipped with the automatic recycling manual openers) on all gravity, conversion, and forced air heating equipment.

Since the CONTROL a complete package, is an all-in-one-unit, the installation and piping is easy—no individual devices to crowd together into limited space. Inventory problems are also simplified.

Field service is a cinch! Simply remove four screws to dismantle either the safety or solenoid head. Why not check the THERMAC MODEL SLS on your furnaces immediately. You'll enjoy top performance and save three ways: installation time, installation space, and overall control cost. Send for prices and delivery.

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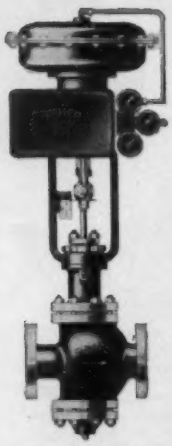
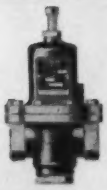
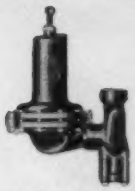


Type 657-A with 3500 Positioner

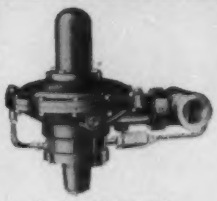
Type 4150 and 4160 Wizard II Pressure Controllers



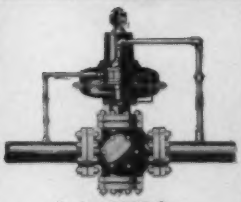
Type 95-H Pressure Reducing Valve



Type 630 "Big Joe" Field Regulator



Series 99-I Multi-Purpose Gas Regulators



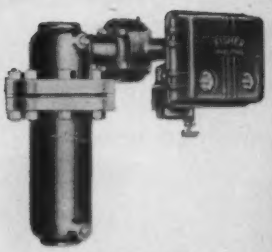
Series 298T Gas Regulators

Type 655-A Pressure Regulator

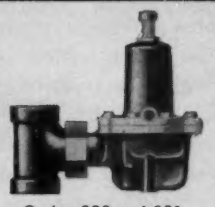
IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

"Supermarket"

give 36 hour Factory service!



Series 2500-249 and
2500-259B
Level-trols
Cage Sizes 14" and 32"



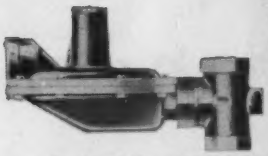
Series 620 and 621
Farm Tap Regulators

Series 67FR Combination Filter Regulator

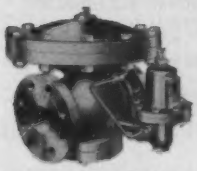
Yes, now you can shop by phone, wire or TWX (Marshalltown 578 or 579) and expect shipment of the equipment illustrated at left in a matter of hours. Now that Fisher Control Valves and Regulators are as readily available as your supermarket groceries, you can meet your emergency needs quickly. Fisher carries a stock of the popular and standard size control valves, displacement type liquid level controllers, pressure regulators and gas regulators on the "supermarket" shelf at all times. The offices in red maintain a wide selection of Fisher equipment in their own inventory.

New items will be added from time to time as needed. Each Fisher representative receives a weekly list of all available types and sizes.

Now, for emergency needs contact either the Fisher representative or the Fisher home office. Your order will be en route within 36 hours (except Saturday and Sunday) after it is received in Marshalltown.



Series S100 and 730
Service Regulators



Type 92B Pilot
Operated Steam
Reducing Valve

AMARILLO
Vinson Supply Company
ATLANTA
J. M. Smither & Company
BALTIMORE
The Rhodes Controls Company
BIRMINGHAM
Joseph W. Eshelman & Company
BOSTON
Clarence B. Petty & Company
BUFFALO
W. J. Sommers Company
CALGARY-EDMONTON
Barber Engineering & Supply Company
CARACAS, VENEZUELA
Sinclair Spence
CHARLOTTE
Robert E. Mason & Company
CHICAGO
General Motors & Controls Company
CINCINNATI
H. T. Porter Company
CLEVELAND
A. E. Ehrke & Company
DALLAS
Vinson Supply Company
DENVER
Joy & Cox, Inc.
DETROIT
DuBois-Webb Company
HOUSTON-CORPUS CHRISTI
Puffer-Sweiven Company
INDIANAPOLIS
Acme Engineering Agency
KANSAS CITY
Sullivan-Mears Company
LOS ANGELES
B. R. Jones & Company
LOUISVILLE
Allan K. Cook Company
MARSHALLTOWN
R. S. Stover Company
MEMPHIS
Johnson & Scott
MEXICO, D. F.
Babcock & Wilcox de Mexico
MILWAUKEE
W. D. Ehrke & Company
MINNEAPOLIS
R. G. Read & Company
MONTREAL
Process & Steam Specialties, Inc.
NEW ORLEANS-LAFAYETTE
John H. Carter Company
NEW YORK
Crabbe & Stebbins Company
ODESSA-FARMINGTON
Vinson Supply Company
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VANCOUVER
Northern Columbia Process Equipment Company
WICHITA-LIBERAL
Sullivan-Mears Company
WINNIPEG
Mechanical Valve & Engineering Spec.

Offices listed in red maintain field stock.

FISHER® Control

SINCE 1880

FISHER GOVERNOR COMPANY

Marshalltown, Iowa/Woodstock, Ontario/London, England

MUELLER®

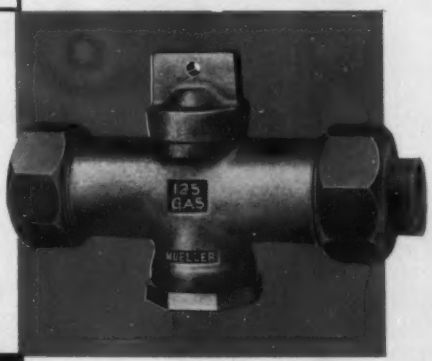
corrosion control

At the main.

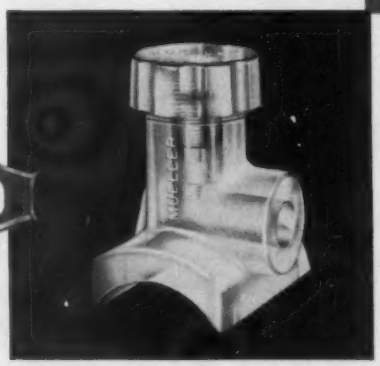
Three different types of tees with a choice of welding or threaded (internal or external) inlets, can give you positive control of corrosion at the main. Mueller NO-BLO® Service Tees, Valve Tees or Curb Valve Tees are available in a complete range of sizes with insulating coupling outlet to fit steel or type "K" copper pipe. Inlets may be welding, outside I.P. or inside I.P. thread.

At the curb.

Mueller Inverted Key Curb Stops can effectively insulate the service line at the curb. Available with insulating couplings to fit steel or type "K" copper pipe. Or if you wish to replace inoperative curb stops or make a new installation in an existing line, use the Mueller cutting-in type Curb Stop with insulating coupling.



NO-BLO®



With plastic pipe.

The Mueller Plastic Tee permits safe, simple service connections to plastic pipe. Tee is solvent-welded to main and service line. Service is actuated by drilling into plastic main under pressure with cutter which is built into the tee. Coupon is retained in cutter. "O" ring seal in completion cap prevents leakage.

Convert to Insulating Couplings. *The Mueller H-11499 Insulating Adapter Gasket permits tees or stops with Dresser Couplings for steel pipe to be converted to insulating couplings for type "K" copper pipe.*

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

MUELLER Since 1857 SERVING the Water and Gas Industries QUALITY

endurance

Cast iron pipe is built to last.
Today, for example, hundreds of gas utilities are still being served by cast iron mains laid fifty years and more ago.
Fifty seven of these can point to a century and more of service!
Amazing as this record is, modernized cast iron pipe, centrifugally cast, is even stronger, tougher, more uniform.
Specify cast iron and your choice is backed by proof... long service records that no other pipe can equal!

Endurance Means Long Service Life!

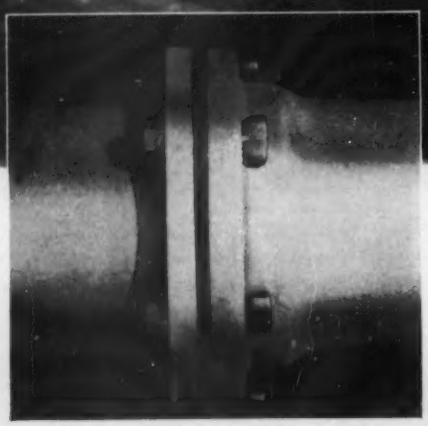
- Standardized mechanical joints are bottle-tight for usual gas distribution pressures... and for all types of gas.
- Centrifugally cast pipe is tough, strong and uniform.
- Joint design allows for deflection during and after installation.
- Service connections are easily made.
- Long life a matter of record.
- No shortages. Cast Iron Pipe is immediately available.

U.S. cast iron PIPE

CAST IRON

U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER
FROM MINES AND BLAST FURNACES TO FINISHED PIPE.



36" mechanical joint cast iron pipe gas main being installed in a Mid-western city.

CAST IRON ®

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

MECHANICAL JOINT cast iron

you're looking at the pipe of the future

no other pipe can match Cast Iron's dependability

In the next hundred years many changes . . . new products and developments . . . will make life a lot different than it is. But the cast iron gas mains laid today will still be serving efficiently.

That's a prophecy based on proof, not promise! 57 American gas companies are still using cast iron mains installed a century and more ago. Hundreds of others are over fifty years old.

And *modern* cast iron pipe, centrifugally cast, is even more rugged. Reassuring thought when you buy pipe — cast iron mains are in to stay and give economical, trouble-free service throughout their long life.

Specify cast iron . . . and be sure.

A FEW OF THE 57 GAS UTILITIES WITH CENTURY-OLD CAST IRON MAINS IN SERVICE

Citizens Gas Fuel Company, Adrian, Michigan—Niagara Mohawk Power Corp. (Gas), Albany, New York—Union Electric Company, Gas Division — Alton, Illinois — Atlanta Gas Light Company, Atlanta, Georgia.

MODERN CAST IRON PIPE IS EVEN MORE EFFICIENT

- Centrifugally cast, it's tougher, stronger, more uniform.
- Standardized mechanical joints are bottle-tight under all gas distribution pressures . . . for all types of gas.
- Uniform wall thicknesses.
- Joint design allows deflection during and after installation.
- Service lengths and variety of standard fittings cut time and labor in congested undergrounds.

pipe FOR MODERN GAS DISTRIBUTION

NEW INTERNATIONAL®
330 UTILITY TRACTOR

NOW! MORE 'BEEF'

than ever before in a 35 hp rig!

It's terrific for trenching, loading, 'dozing! Now you can get an International tractor in the economical 35 hp class, with strength and stamina for high capacity and low maintenance. The new International 330 Utility has up to 900 pounds greater built-in weight than other tractors of similar horsepower—really *rugged* construction! Handle 1,000 pounds with a front-end loader, lift 4,000 pounds with rear-mounted fork, dig faster with heavy-duty backhoe.

ALL the work-easing features of larger IH tractors are available—10 speeds forward with Torque Amplifier drive . . . power steering . . . job-tailored Hydra-Touch equipment control . . . Fast-Hitch.

See how heavy-duty design can cut your costs! Look in the classified directory . . . phone your IH Dealer. For free catalog, write International Harvester Co., Dept. OGJ-1, P. O. Box 7333, Chicago 80, Ill.

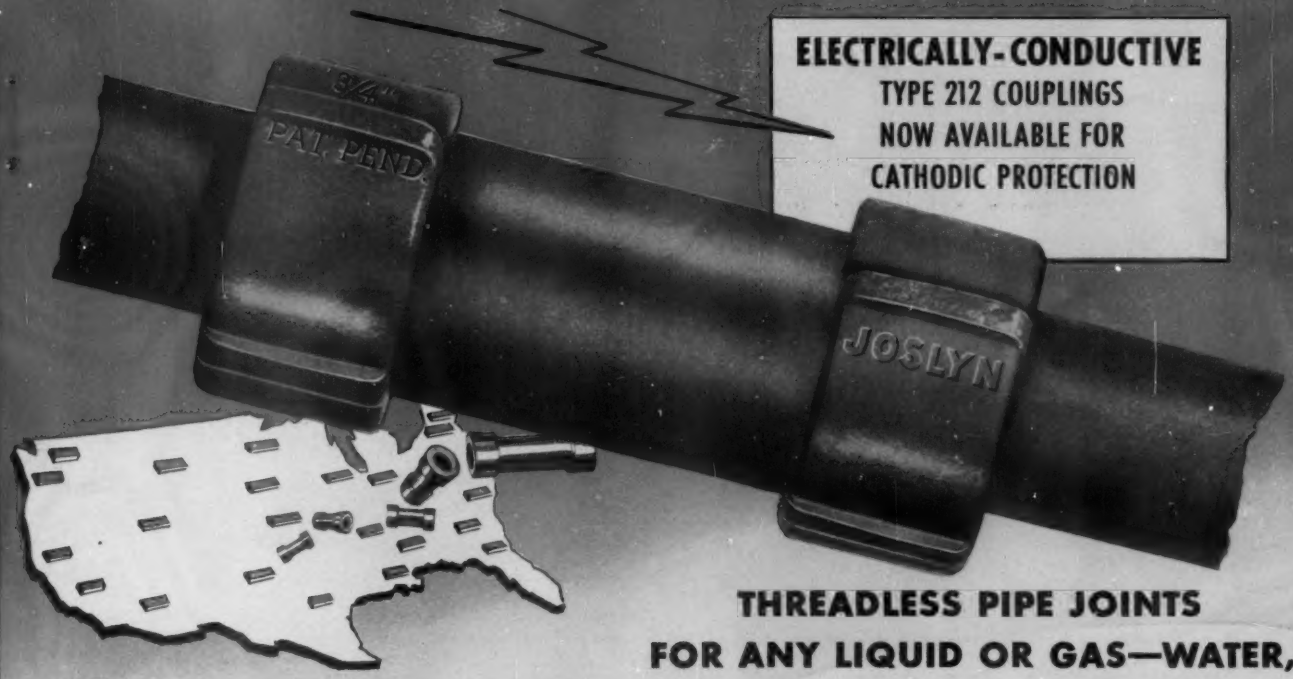
SEE YOUR
INTERNATIONAL HARVESTER DEALER

International Harvester Products pay for themselves in use—Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

International tractors with matched loaders and backhoes are now available as complete units—backed by unexcelled IH facilities for parts, service, and financing. Above, the new International 330 Utility tractor equipped with International Wagner backhoe and loader. Below, the 330 Utility with International Pippin units.

For extra-rugged service, ask your IH dealer to show you the husky, 45-hp International 350 Utility . . . Over 5,500 lb drawbar pull. Below, ½-cu yd rear-mounted rotary scoop.

JOSLYN ANNOUNCES NEW COMPRESSION COUPLINGS*



ELECTRICALLY-CONDUCTIVE
TYPE 212 COUPLINGS
NOW AVAILABLE FOR
CATHODIC PROTECTION

THREADLESS PIPE JOINTS FOR ANY LIQUID OR GAS—WATER, OIL, GAS, CHEMICALS, ETC.

At last, a compression coupling specifically designed to provide a low-resistance electrical joint essential to cathodic protection systems.

The Joslyn Type 212 E-C Coupling combines all the features of the Type 210 Standard Coupling and, in addition, assures sealed-in bond when compression nuts are tightened.

Both types simple to install, fully re-usable, permanently leak-proof, and economical.

Design eliminates thread-cutting and close fitting of pipe—insures compression seal of gasket without friction or seizure—produces high compression sealing force at gasket surfaces.

Available from stock at Joslyn Warehouses all over the country.

Write Department TS-2 For Complete Information

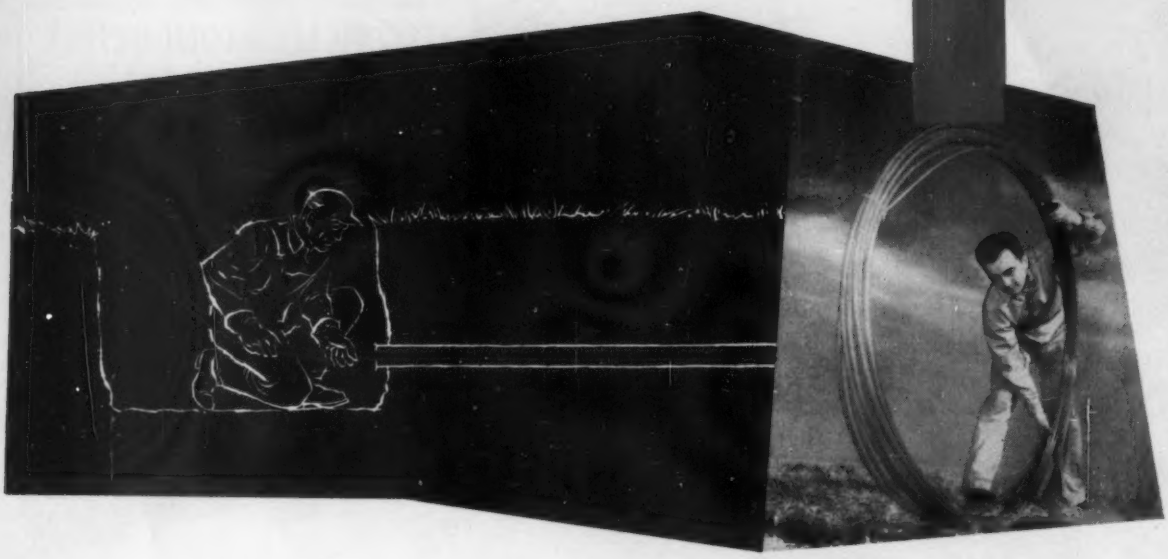
Also available in other materials for special applications *Patent No. 2,816,472

JOSLYN MFG. AND SUPPLY CO.

WM. E. PRATT FOUNDRY DIVISION

155 North Wacker Drive • Chicago 6, Illinois

Tubing of Tenite Butyrate speeds replacements



You dig two holes instead of a ditch

Replacing corroded service lines is a much simpler operation when using plastic tubing of Tenite Butyrate. Trenching is eliminated—since holes are dug only at the main tap and service riser, with the new flexible tubing being run right through the old pipe.

Customers prefer this method because it saves their lawns and paved areas.

Field crews prefer this method because tubing made of Butyrate is light and easy to handle.

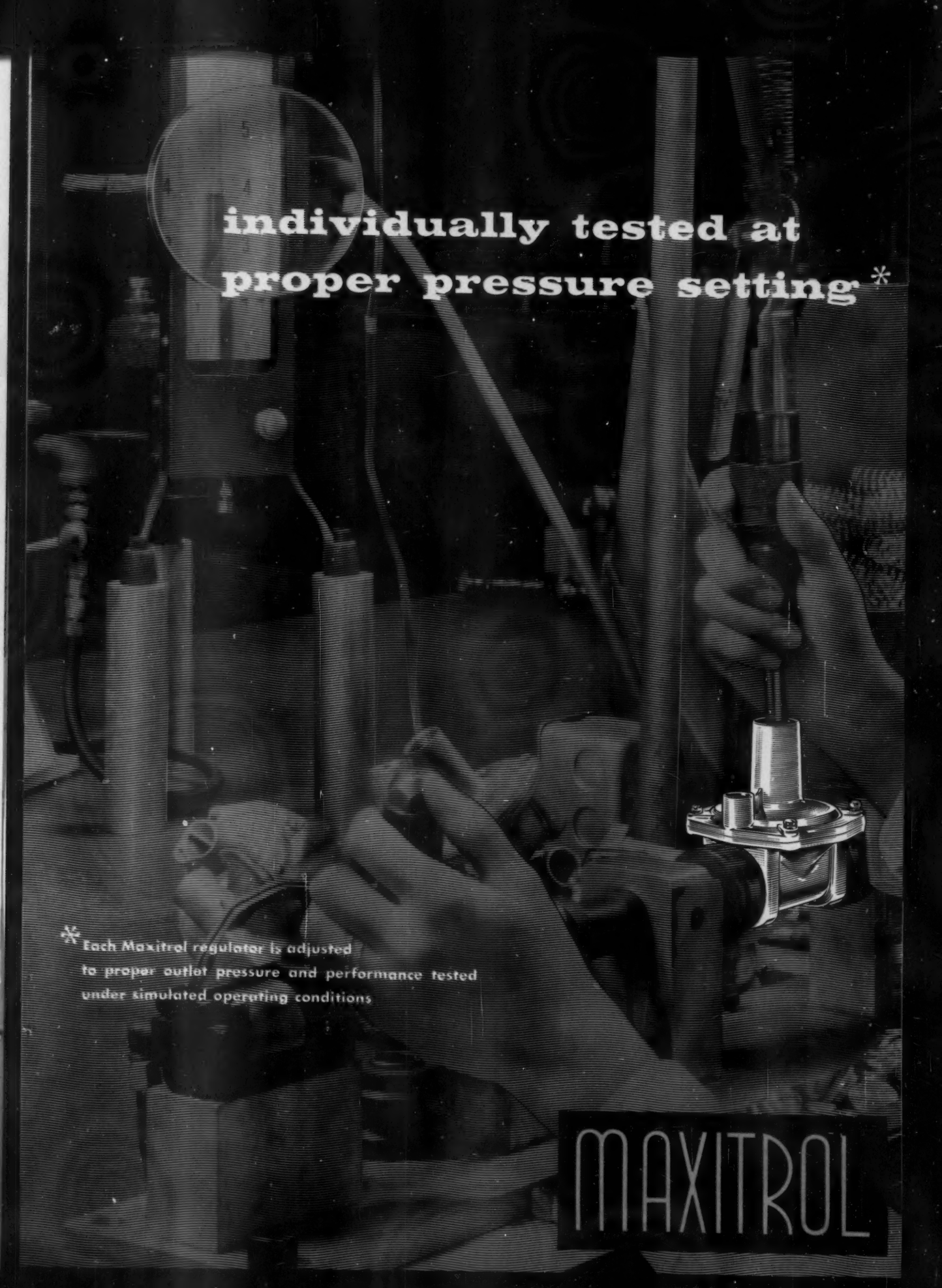
The entire length of tubing required for an average service of 70 feet weighs less than four pounds. Joints need no asphalt protection and simple adaptors make connections between tubing and metal pipe. What's more, tubing of Tenite Butyrate is not subject to the corrosive and electrolytic attack of the soil, assuring many years of trouble-free service.

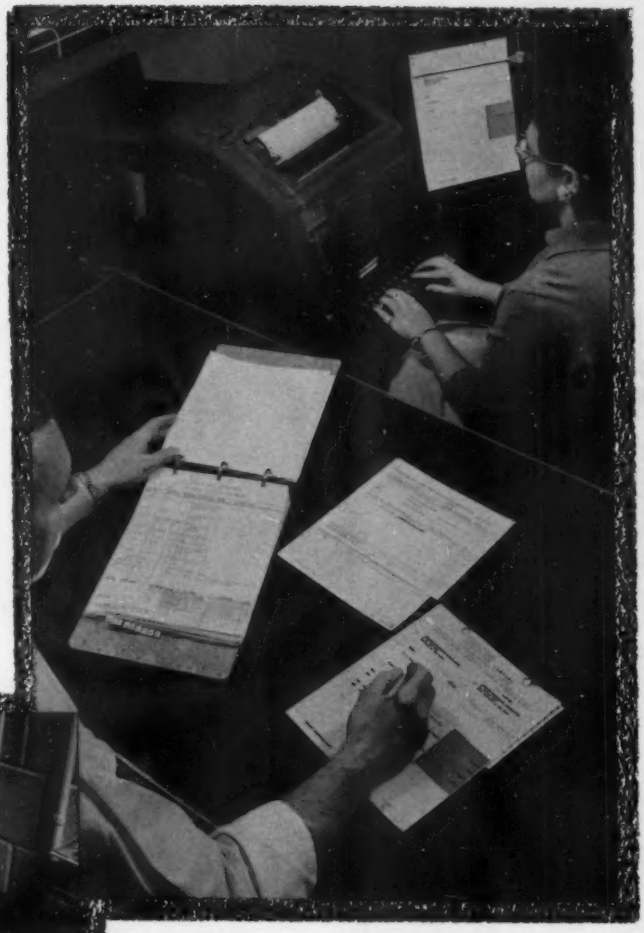
Since 1943, tubing of Tenite Butyrate has been a familiar friend to the gas industry—cutting installation time for service replacements and for new services as well. One company has already installed nearly 3,000,000 feet of tubing made of Tenite Butyrate. More recently, several progressive utilities have also installed *mains* of Tenite Butyrate.

Discover how this versatile Eastman plastic can help you in your operations. Send for literature describing the tubing, its fittings, and installation methods in natural gas service application. Ask, too, for the names of suppliers near you handling tubing of Tenite Butyrate. Write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

A 16mm. sound-color film, "Plastic Pipelines," is available upon request.

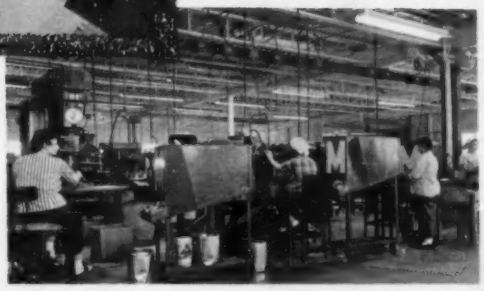
TENITE
BUTYRATE
an Eastman plastic


individually tested at
proper pressure setting*
* Each Maxitrol regulator is adjusted to proper outlet pressure and performance tested under simulated operating conditions
MAXITROL

new system speeds delivery on special orders

Manufacturing to customer's special needs now is done on the same speedy delivery basis as shipments of stock regulators. Thanks to a new expediting system that includes customer specification sheets, private wire teletype machines, and excellent production control, Maxitrol can meet rush deliveries on your gas regulator requirements.

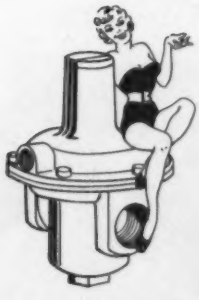
With this system, incoming purchase orders showing your part numbers or ours are acknowledged and then processed from the *Maxitrol Customer Specification Sheet*. The specification sheet gives Maxitrol model number, pressure setting, vent position, necessary accessories and pertinent information. The orders, bearing this added information, are relayed by teletype to the manufacturing facilities in Colon, Michigan.

At Colon, the order is received by teletype and the specifications verified on an identical copy of the *Maxitrol Customer Specification Sheet*. The order then is quickly processed in the plant.



High production, precision manufacturing at the new facilities in Colon assure prompt completion of the order.

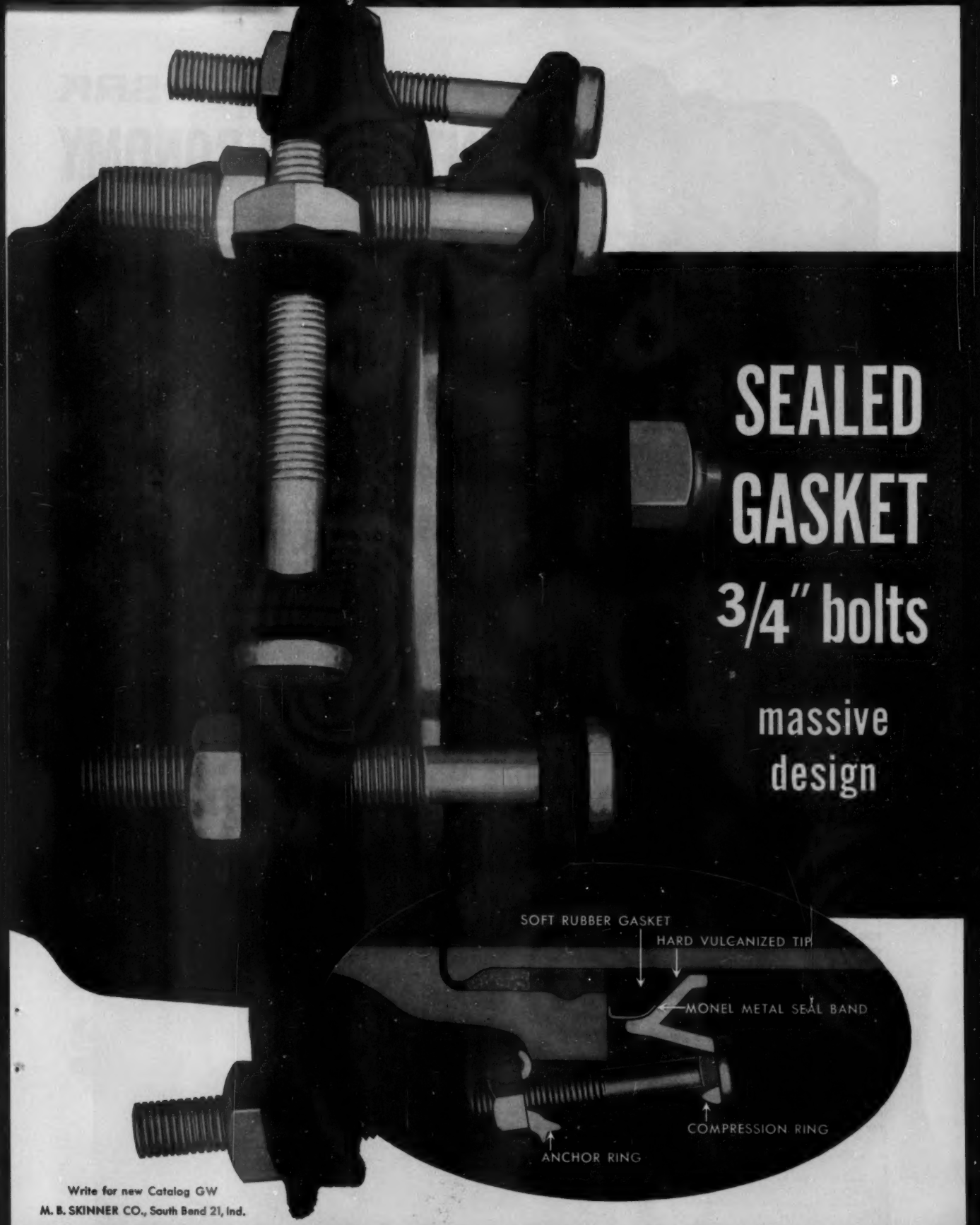
Shipping is expedited over the best routes which are recorded on the customer specification sheet.



"According to the customer specification sheets I'm a necessary accessory."

MAXITROL

MAXITROL COMPANY • 12200 BEECH RD. • DETROIT 39, MICH.



Write for new Catalog GW
M. B. SKINNER CO., South Bend 21, Ind.

SKINNER-SEAL BELL JOINT CLAMP

Republic SRK
GAIN 3-WAY ECONOMY

SAVINGS OF MORE THAN ONE-THIRD over the cost of conventional service lines have been reported by a leading gas company in the South through the use of Republic SRK Plastic Pipe for new installations. Even greater savings, plus preservation of customer good will, can be gained on replacement jobs. Using the existing line as a conduit, Republic SRK can be threaded from main tap to riser without trenching. Send coupon for details.

YOU CAN GET THE CORROSION PROTECTION OF PLASTIC PLUS THE STRENGTH OF STEEL with Republic's new X-TRU-COAT pipe and tubing. Actually two pipes in one, plastic over steel, X-TRU-COAT is ideal for a wide variety of applications in which external corrosion is a problem. The tough polyethylene coating is continuously extruded over a special elastic adhesive undercoat forming a solid, permanent bond with the steel pipe. X-TRU-COAT can be bent and joined by conventional methods. Joints are corrosion protected by a primer covered with pressure-sensitive tape. For details, send coupon.

Plastic Pipe helps you
IN SERVICE ENTRANCE LINES

For new or replacement gas service entrance lines, use of Republic SRK (Semi-Rigid Kralastic) Plastic Pipe enables you to cut costs in three areas:

FIRST—Low initial cost of Republic SRK provides immediate savings in capital investment.

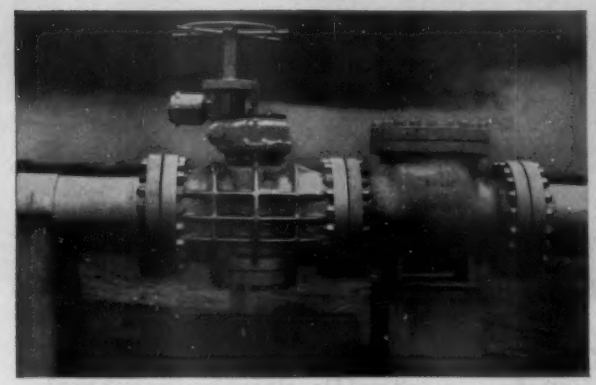
SECOND—Extreme ease of installation provides substantial savings in construction costs.

THIRD—Because Republic SRK is immune to electrolytic action as well as acidic and alkaline soils, maintenance and replacement caused by these conditions are eliminated.

In addition to these cost saving characteristics, Republic SRK has high impact strength to withstand mechanical abuse in handling and installation. Light in weight and readily cut with ordinary hand saws, it is joined by solvent-welded sleeve couplings to form, in effect, a one-piece line of any required length.

Finally, Republic SRK Plastic Pipe in tubing sizes is ideal for renewing existing lines. Trenching can be eliminated by simply digging a hole at the main tap and another at the riser. Republic SRK, joined by internal connectors, can then be threaded through the old line and joined to metal pipe with special adapters.

For full information on top-quality, cost-saving Republic SRK Plastic Pipe, contact your local Republic office or mail coupon.



REPUBLIC ALLOY STUDS and high carbon hex nuts provide tremendous clamping force to assure leak-proof performance in a wide variety of high pressure equipment assemblies. Clean, accurate threads provide maximum holding power, resistance to wear, and trouble-free backoff whenever required. To protect the designed-in reliability of your equipment, specify Republic fasteners. Send for data.

COSTLY WELDING BURN-THROUGHS DUE TO THIN SPOTS cease to be a problem when you install pipe lines of Republic Electric Resistance Weld Line Pipe. Reason is absolute uniformity in wall thickness and concentricity. Accurate line-up for welding is assured. Moreover, high ductility and yield strength simplify bending and provide high pressure dependability. For facts, send coupon.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. GS-5329
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send me further information on:

☐ SRK Plastic Pipe ☐ Continuous Weld Steel Pipe
☐ Alloy Studs ☐ Electric Resistance Weld Line Pipe

Name_____ Title_____

Company_____

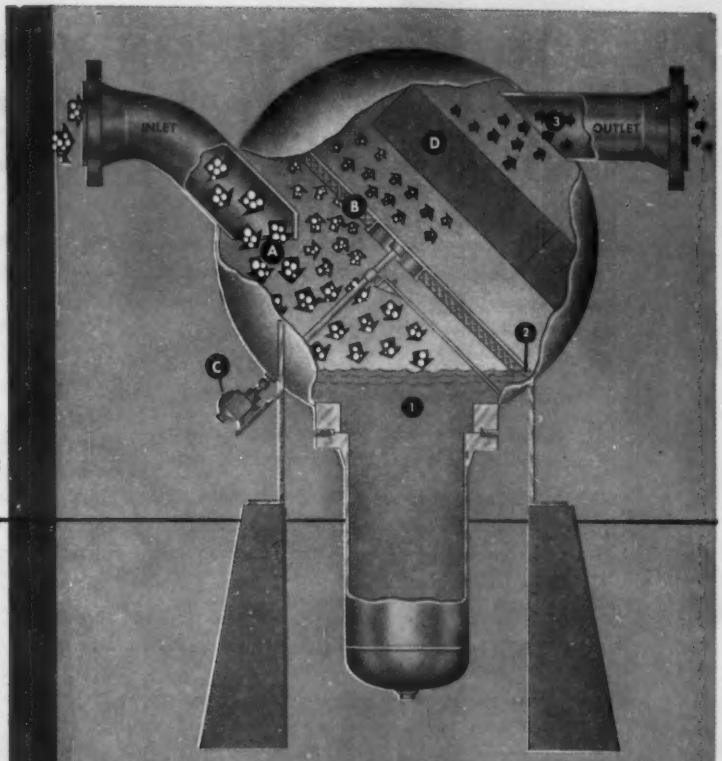
Address_____

City_____ Zone____ State_____

MORE EFFICIENT RESULTS!

PEERLESS SCRUBOSPHERE*

*Spherical scrubber for dust and liquid removal from gas flow

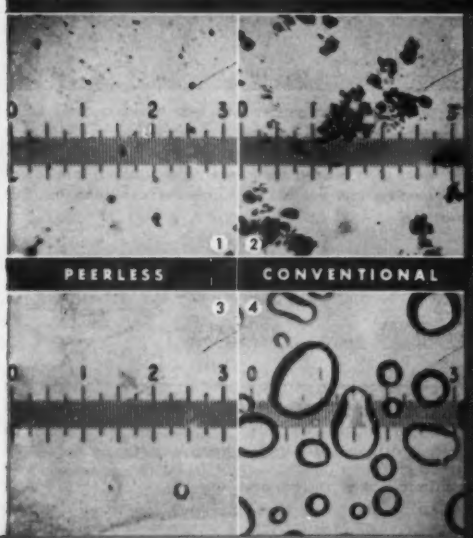


(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving through liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3



These photographs were made of microscope slides introduced downstream of the Scrubosphere and a conventional vertical oil bath cleaner under the same operating conditions. Plates 1 and 2 show the comparative amounts of iron oxide not removed with the amounts introduced being identical. Plates 3 and 4 indicate comparative oil loss with vapor rate through the vessels being the same.

LOOK AT THIS TEST The test at the left indicates the superiority of Peerless Scrubosphere over conventional oil bath dust scrubbers. The SCRUBOSPHERE operates with no loss of efficiency at low flows, minimum liquid loss, and very low pressure drop. Other outstanding features include easy vessel access with removable self-cleaning contactor, a sump for slugs of solid or liquid particles, and minimum cost.

For detailed information write for Bulletin No. 181

PEERLESS MANUFACTURING CO.

P.O. Box 13165 Dallas, Texas

Representatives in All Principal Cities

PEERLESS MFG. CO. DALLAS TEXAS

We Have to Make it Better Than Anybody Else!

Tex-Tube electric resistance weld pipe

BECAUSE we are the newest manufacturers our reputation is on trial with every piece.

We keep yield points, tensile strengths, and elongations well above the minimum.

We stay well inside specifications on dimensional tolerances.

We never ship border line material. We scrap it!

TEX - TUBE, INC.

1503 NORTH POST OAK ROAD • HOUSTON, TEXAS

Sales Offices in Midland, Texas - Tulsa, Oklahoma - Baton Rouge, Louisiana

LICENSED BY THE AMERICAN PETROLEUM INSTITUTE

CONSTANT AIR PRESSURE INSURES A UNIFORM CUT WHEN DRILLING GAS MAINS UNDER PRESSURE: The above Mueller C1-36 Drilling Machine, powered by Jaeger "125" rotary compressor, is drilling a 10" main under pressure, preparatory to installing line stopper plug. The constant, unfluctuating air pressure maintained by the Jaeger rotary is of great importance for this work. It insures the uniformly accurate cut, by the drilling machine, which is needed for proper seating of the inserted plug. Job pictured is in North Carolina.

By far the most efficient compressor

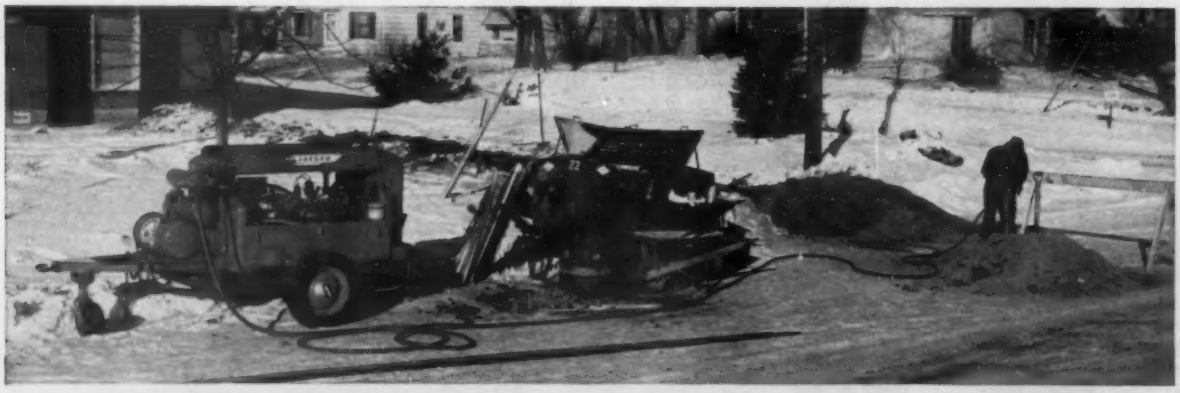
There are two good reasons for the rapidly increasing use of Jaeger rotary air compressors for utility installation and maintenance work:

1: The Jaeger produces the same volume of air as other rotaries *at 100 to 150 rpm slower engine speed,* using less horsepower, less fuel and correspondingly less wear on engine and compressor. (Full load speed in a Jaeger "125" is only 1700 rpm, in a Jaeger "600", it is only 1650 rpm.)

2: In a Jaeger rotary the air delivery is instantaneous and so closely regulated that pressure holds *constant* under all normal work demands. Speed modulation is smooth and completely stepless over the entire operating range and over-run and racing of the engine are positively prevented. Air tools operate smoothly and at top efficiency at all times.

Jaeger controls are also very simple—no complex linkage, toggles or metering orifices.

THE JAEGER MACHINE COMPANY 661 Dublin Avenue, Columbus 16, Ohio • Canadian Plant, St. Thomas, Ont.



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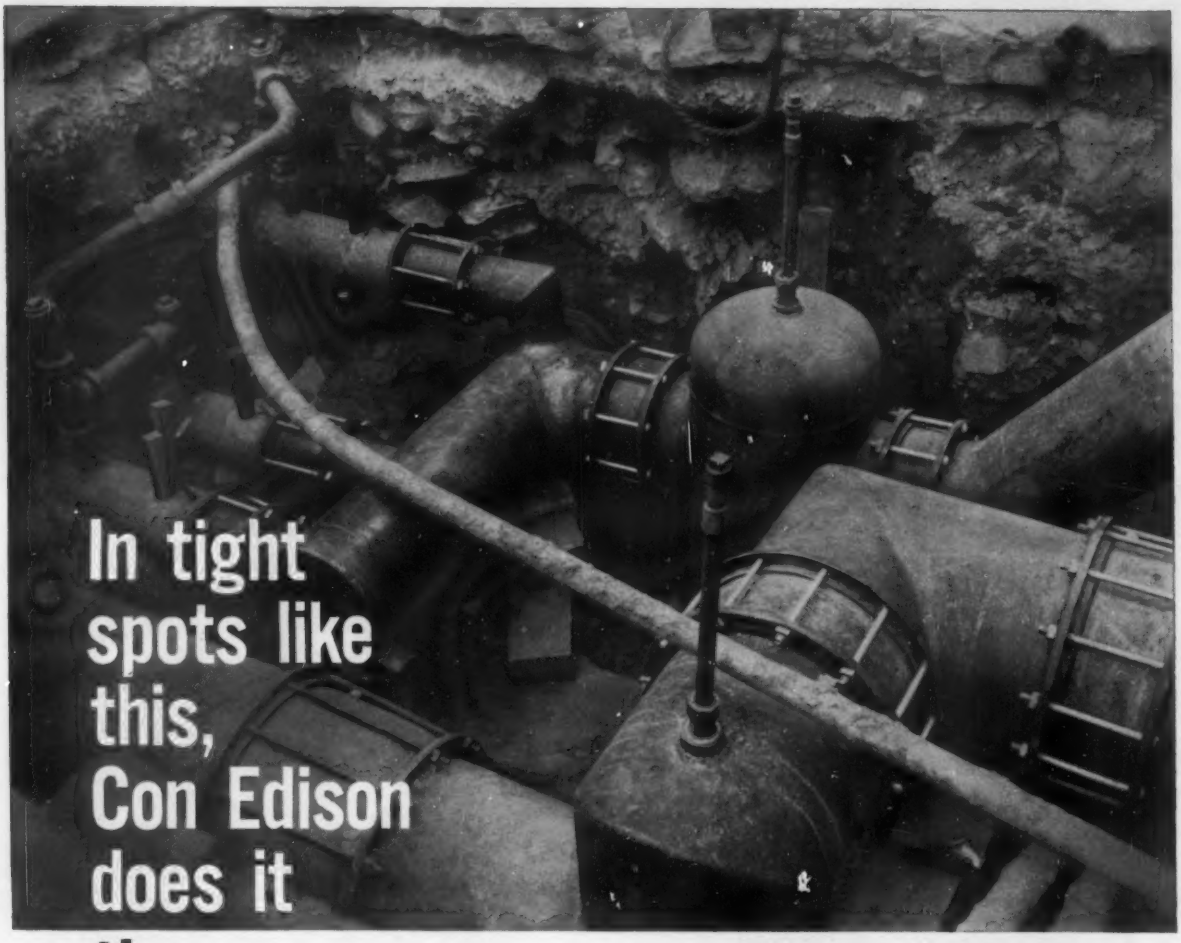

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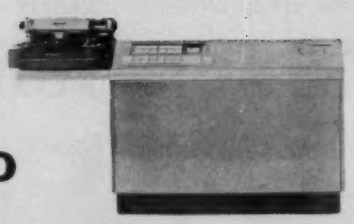

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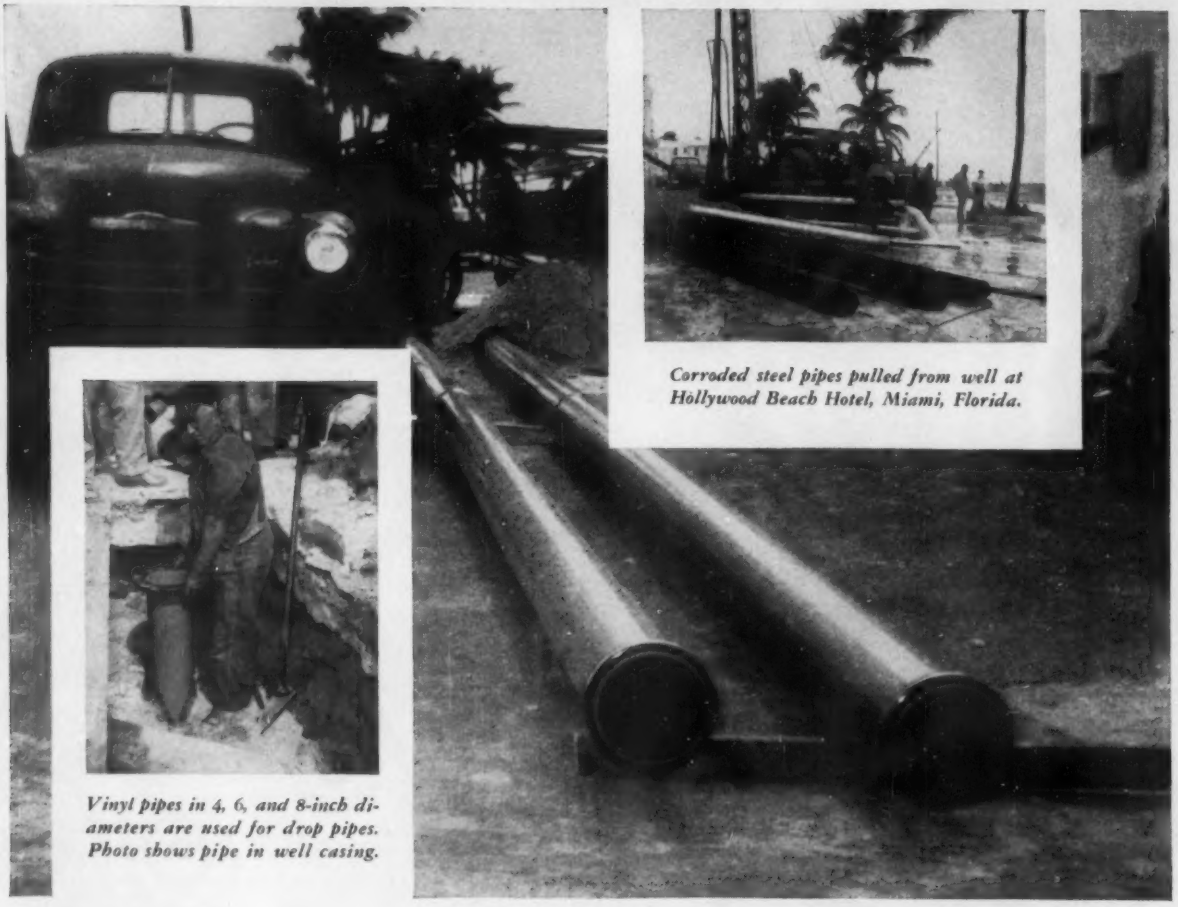

Corroded steel pipes pulled from well at Hollywood Beach Hotel, Miami, Florida.

Vinyl pipes in 4, 6, and 8-inch diameters are used for drop pipes. Photo shows pipe in well casing.

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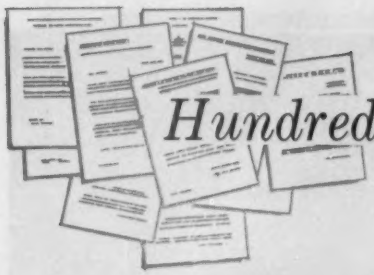

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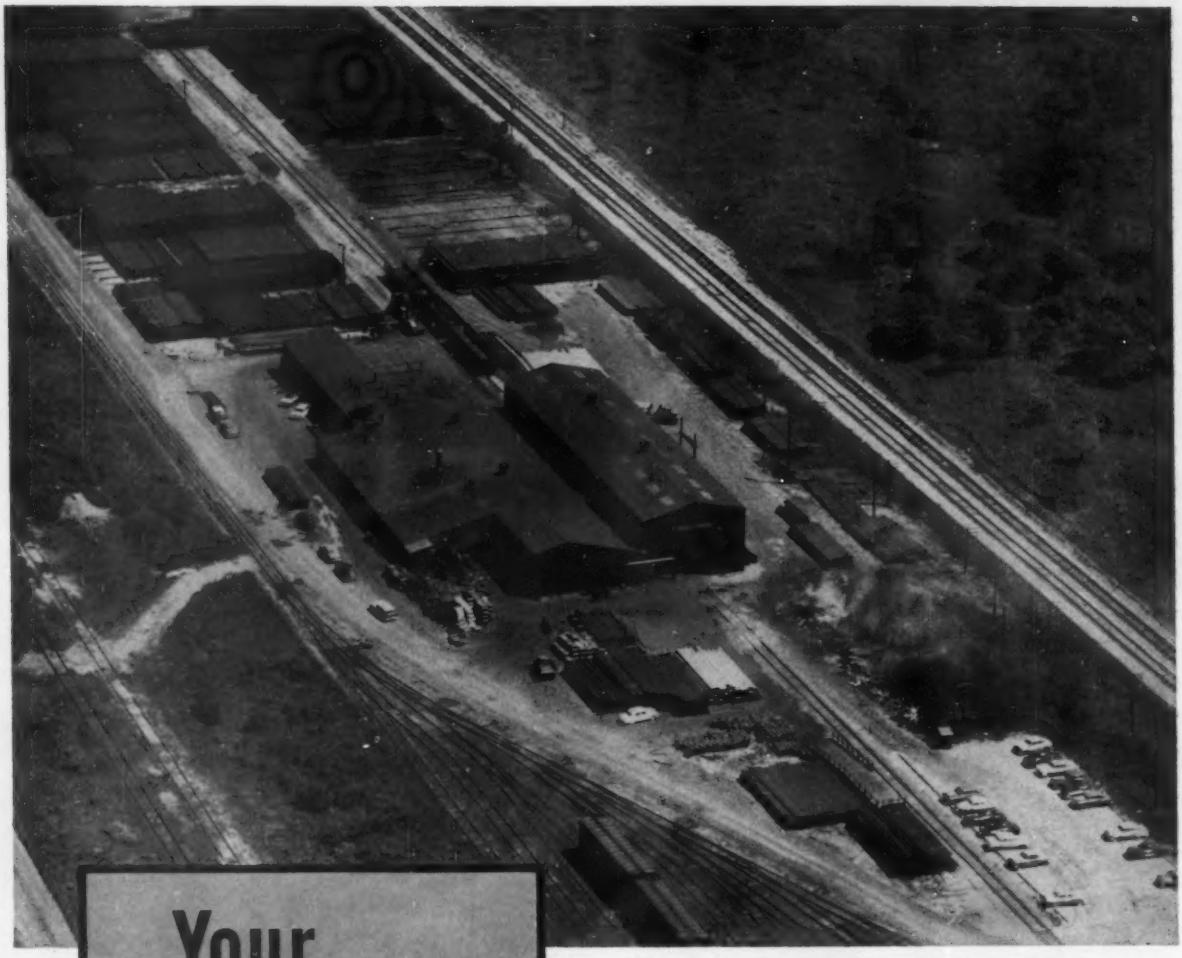

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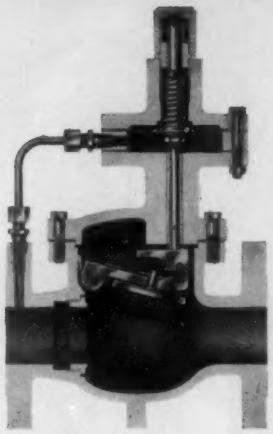
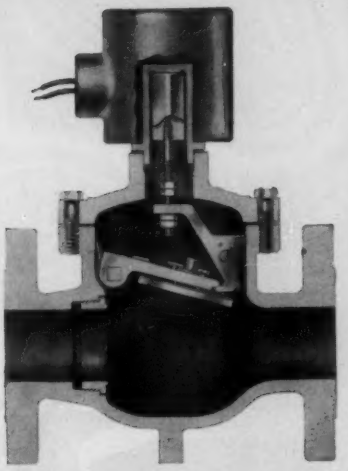


Model 1500H shown, is a high pressure shut-off valve which closes automatically and instantly when predetermined high pressure is reached. With addition of a fusible metal plug, valve can be furnished to shut off on overpressure and/or over-temperature. With control pressure above diaphragm, valve can be made into a low pressure shut-off valve. Combination high and low pressure shut-off also available.



Model 1700 shown, is a Solenoid operated valve normally energized to maintain valve in open position. On interruption of electric current valve closes instantly. Model 1800 Solenoid shut-off valve available to shut off gas instantly by applying electric current either automatically or through a "panic" button.

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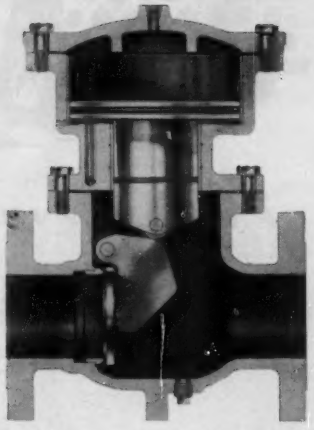

Model 3000 shown, is a piston operated valve, which opens instantly when pressure above the piston is released. Restoring the pressure above the piston closes the valve. The operating pressure above the piston can be obtained from the line or from an independent source of gas or liquid and can be automatically released or applied by instrument air or gas operated pilots or by use of a small three-way Solenoid valve.

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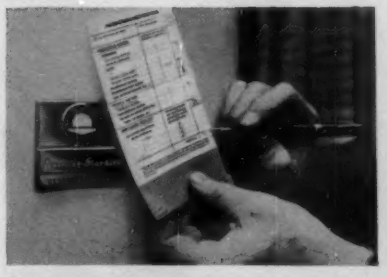

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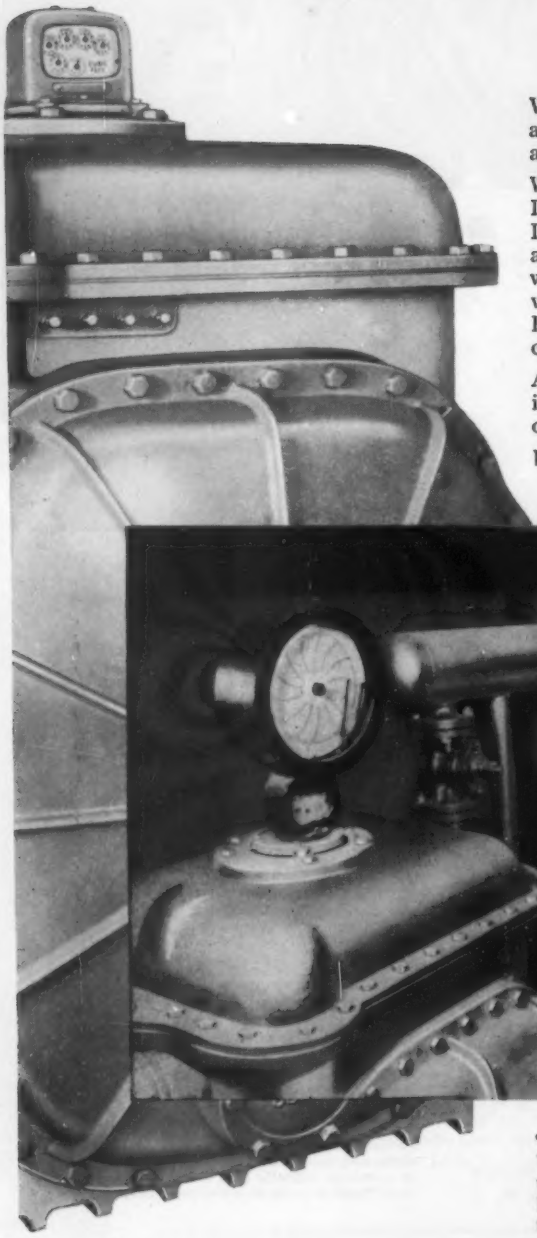

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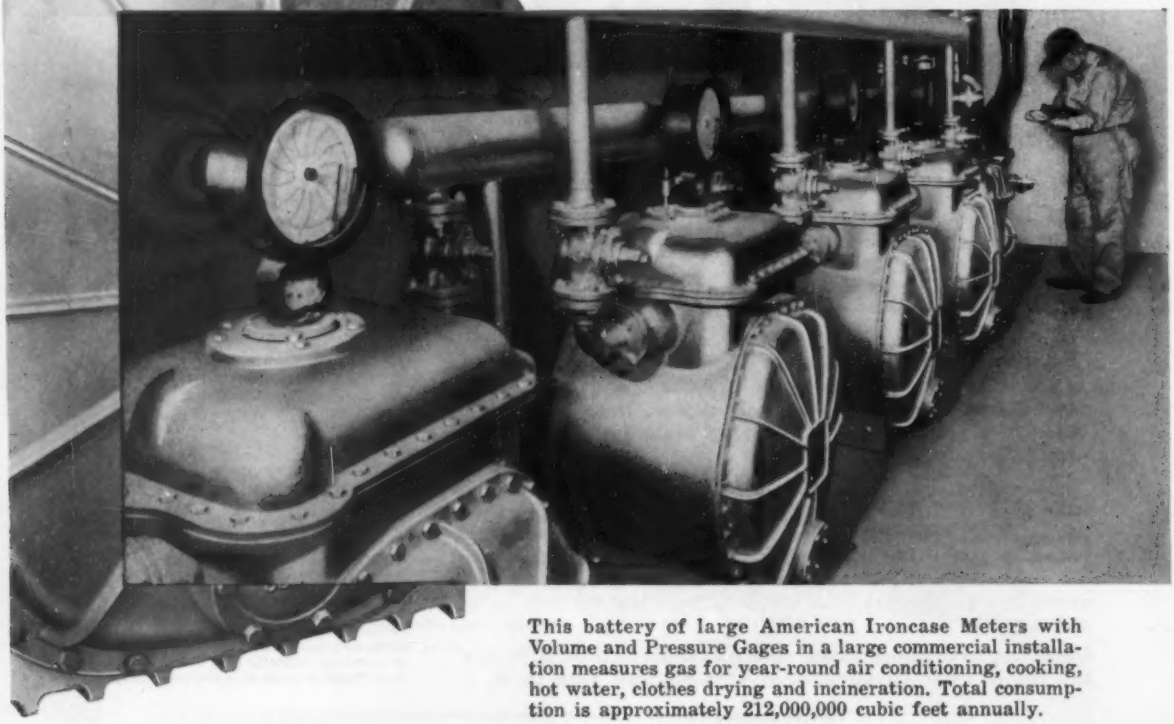

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MARCH 1958

PLASTIC PIPE-CORROSION PREVENTION ISSUE

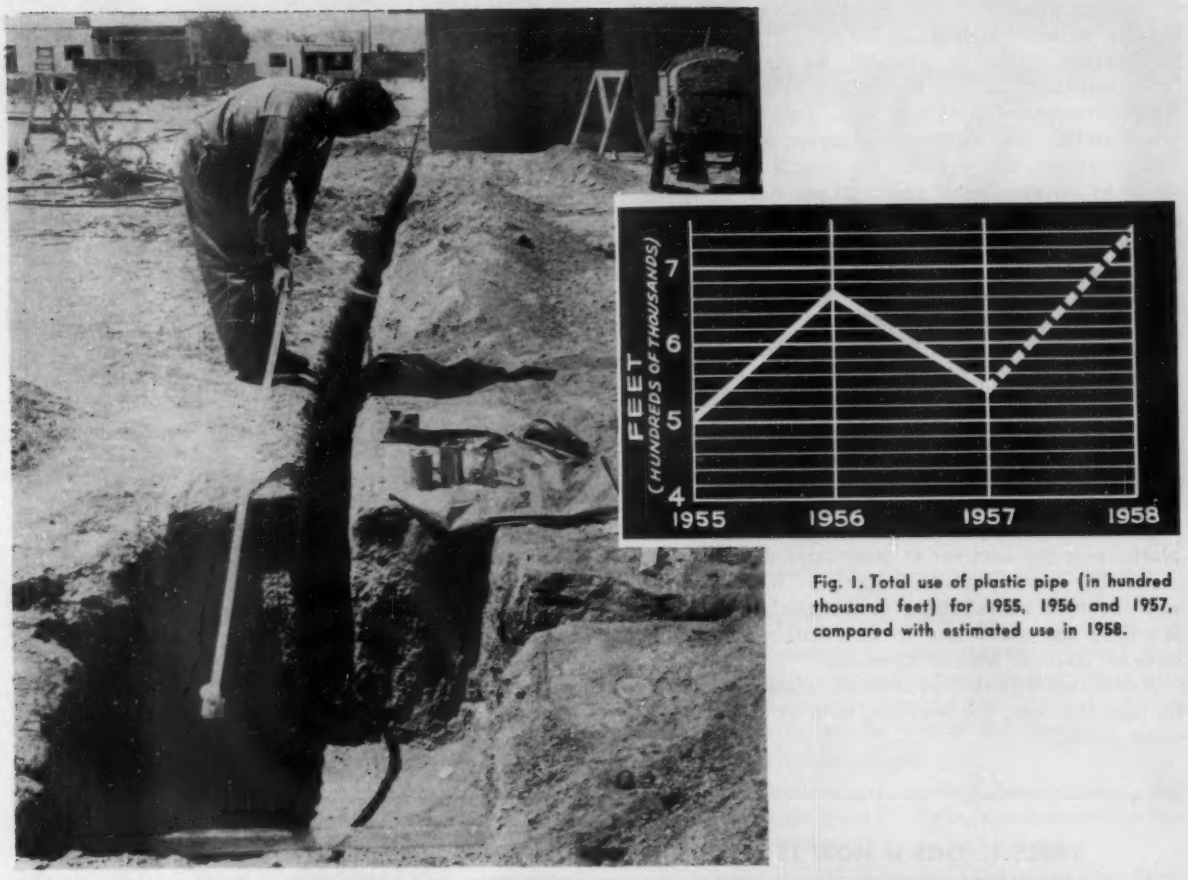


Fig. 1. Total use of plastic pipe (in hundred thousand feet) for 1955, 1956 and 1957, compared with estimated use in 1958.

1958—Another good year for plastic pipe

By DON WRIGHT • Managing Editor

PLASTIC pipe will continue its steady, though unspectacular, growth throughout the gas industry in 1958. *GAS'* annual survey of plastic pipe usage in distribution companies shows that 30 companies plan to use 727,990 ft of this piping for operational installations this year.

True, plastic pipe is still being measured by the foot, while universally accepted distribution piping such as steel and cast iron is measured by the mile. Still, the planned use of 727,990 ft is encouraging when compared with the 1957 figure—543,774 ft in operational installations.

Fig. 1 shows the yearly footage of plastic pipe used in 1955, 1956, and 1957, compared with the anticipated use this year. Though plastic pipe has been used in varying degrees in the gas industry since 1946, it

was not until *GAS* made its first comprehensive survey of the industry in 1956 that the total footage became known.

The graph shows that plastic pipe has had its ups and downs. Last year, its use fell off rather markedly from the banner year of '56. But, 30 companies told *GAS* that they'll use 727,990 ft this year—topping 1956 by a healthy margin. Too, at least three major users of plastic pipe did not reply. It is a safe assumption that the market for plastic pipe will exceed 775,000 ft in the gas industry this year.

Of the 30 companies who report they will use plastic pipe operationally in 1958, 23 used it last year. The seven who didn't use it in '57 have used it before, mainly on experimental basis.

Nineteen of the 23 who did use plastic last year will increase their use this year. These 19 plan an average increase of 38 per cent. Two '57 users will continue this year on the same degree, and two others will decrease. The two who say they'll cut down will do so by an average of about 20 per cent.

In addition to the 30 operational users, seven others without previous plastic pipe experience will begin experimental installations this year. Four of these companies are in the East, two in the Midwest, and one in the Southwest.

These experiments no doubt will determine the future of plastic pipe in the companies. A distribution engineer in one of the testing companies (a major eastern distributor with several operating divisions) describes his company's attitude this way:

"Two of our divisions are going to experiment with plastic pipe for services in the near future. Their results will determine whether or not we will use plastic pipe for services at some later date."

Another eastern utility reports: "We are experimenting with some tubing in the yard of our plant. We have not placed any in distribution service, and have no plans at present to do so."

A Midwest distribution company plans to test plastic pipe this year for services, both by insertion and direct burial.

Other companies are interested, but aren't ready yet to start testing. A municipal system in the West says: "We are waiting for more complete performance records and universal acceptance." An eastern utility believes "that sufficient testing is being done by others, and (we) are awaiting results."

• How it was used in 1957

If last year's usage is any indication, gas companies in 1958 will use plastic pipe mainly for inserts in old service lines. Of the 543,774 ft used in '57, 444,097 ft were used for insertion in, or replacement of, existing services. Most of this was used for inserts.

Next most popular use in 1957 was for new services, 62,800 ft. Then came new mains, 31,639 ft, and insertion in, or replacement of, existing mains, 5238 ft.

Table 1 shows how several of the major users of plastic pipe used it last year.

Distribution engineers have found that plastic pipe can be used advantageously in rather unusual situations, too. Wisconsin Public Service Co. used it to solve a condensate problem in a river crossing (see page 64). And Louisville Gas & Electric Co. has made a regular practice of using a 2- to 3-ft section of plastic pipe for insulating new services (see page 67).

• Experienced users seem satisfied

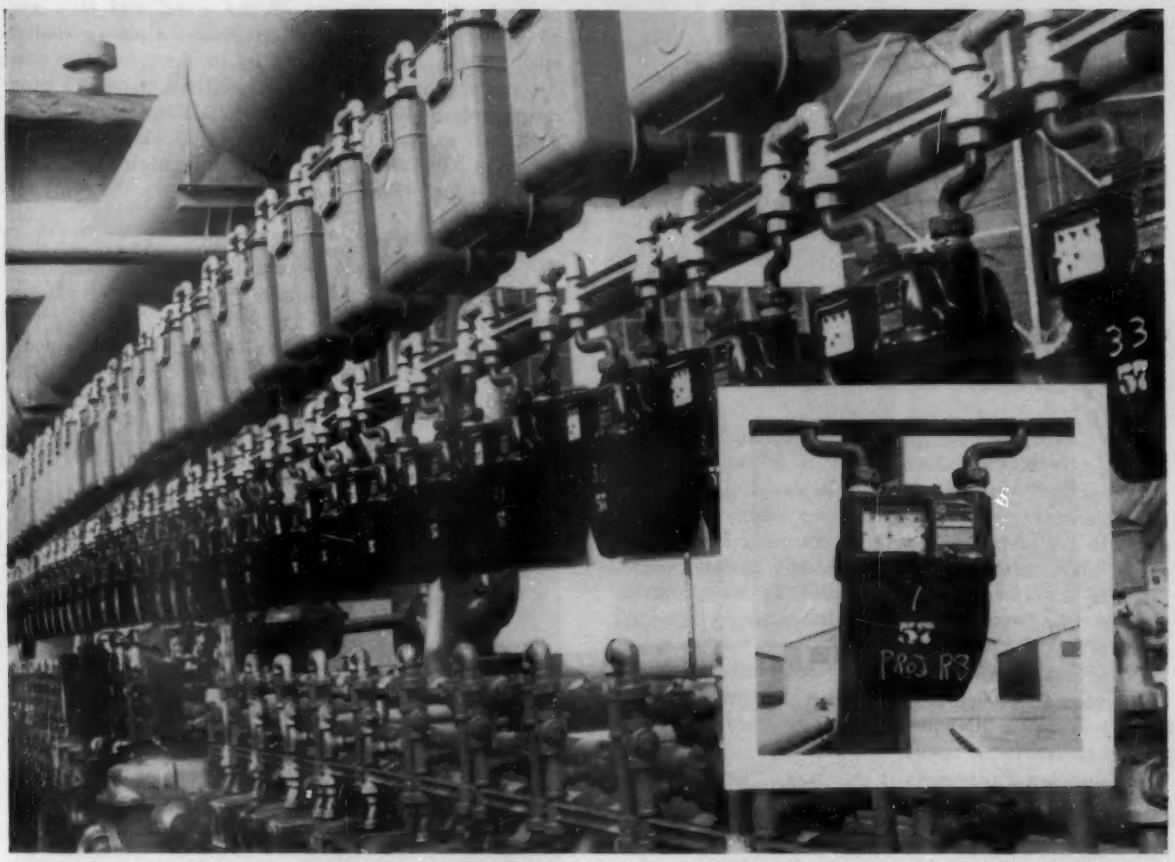
Those companies who have been using plastic pipe operationally for any length of time seem to be satisfied with it.

Since the product was introduced to the gas industry at the close of World War II, more than 5.4 million ft of plastic pipe has been put into the ground. Southern California Gas Co. (Los Angeles), one of the first utilities to use it, still leads in total footage —more than 3 million. Now, it is still evaluating the results. A SoCal official explains:

"Tabulation (of the information asked for by *GAS*) would indicate that we did not use any plastic in 1957, that we probably will not use any in 1958, but that we consider plastic piping successful from an operat-

TABLE 1. THIS IS HOW 15 DISTRIBUTION COMPANIES USED PLASTIC PIPE IN 1957

		How Used In 1957					
		Services		*Mains*		*Est.*	
	1957 Total	*New*	*Insert*	*New*	*Insert*	*1958 Usage*	*Type Used*
Arizona Public Service, Phoenix	4,000	1,000	3,000	—	—	10,000	Cellulose acetate butyrate, PVC, polystyrene copolymers
Ark.-Mo. Power Co., Blytheville, Ark.	10,000	3,500	—	6,500	—	30,000	Polyvinyl chloride
Associated Nat. Gas Co., Blytheville, Ark.	3,000	1,000	—	2,000	—	10,000	Polyvinyl chloride
Cheyenne Light, Fuel & Power Co.	2,036	—	2,036	—	—	3,000	Butyrate
Gas Service Co., Kansas City, Mo.	14,000	—	14,000	—	—	12,000	Polyvinyl chloride
Kansas Power & Light Co., Salina	17,832	—	17,832	—	—	49,250	Butyrate
Louisville Gas & Electric Co.	12,500	12,500	—	—	—	12,500	Butyrate
Northern Indiana Public Service	4,000	—	4,000	—	—	6,000	Cellulose acetate butyrate
Palo Alto (Calif.) Gas Dept.	36,157	16,779	6,234	13,144	—	40,000	Styrene copolymer
Peoples Gas Light & Coke Co., Chicago	350,000	—	350,000	—	—	350,000	Cellulose acetate butyrate
Peoples Natural Gas Co., Pittsburgh	4,600	—	—	4,600	—	10,000	Polyvinyl chloride
Public Service of Colorado, Denver	57,000	21,000	36,000	—	—	75,000	Cellulose acetate butyrate
Pueblo Gas & Fuel Co.	4,505	—	4,505	—	—	6,000	Cellulose acetate butyrate
Tucson Gas, Elec. Light & Power Co.	8,000	2,000	2,000	1,500	2,500	10,000	Modified styrene
United Gas Corp., Texas Div.	2,673	—	—	2,673	—	6,000	Polyvinyl chloride



New plastic case gas meters (center row, black in color) are being tested on run-in rack by a major distribution company. Inset shows closeup of new meter, which is still in experimental stage.

ing point of view. These things obviously do not reconcile without additional information or discussion. The point is that thus far the plastic is performing satisfactorily, but after all, the oldest we have is only 10 or 12 years old, and this is a relatively short time in the life of a main or service. Since we have an appreciable amount of plastic in service, we think it is only prudent to wait a while to see the effects of time.

"We do, however, periodically re-evaluate to see if we should start using plastic again."

Next in line as far as total installed footage is concerned is Peoples Gas Light & Coke Co. (Chicago). This utility has put nearly 1.4 million ft of plastic into operation since December 1952. It is used strictly for insertions in existing services (see page 59).

Another distributor using a good amount of plastic is Southwest Gas Corp., which operates in Las Vegas, Nev. (formerly Nevada Southern Gas Co. in Las Vegas) and the southeastern section of San Bernardino county, California. Southwest Gas has been a steady user of plastic for new services for several years (see *GAS*, March 1957, "Nevada Southern uses plastic pipe for new services," pp. 65-68) in Las Vegas. Now, it is installing 2-in. plastic mains in systems in the California desert communities of Hinkley and Lucerne.

• Is it successful operationally?

GAS asked each company surveyed, "Do you consider plastic pipe successful from an operating point of view." The answers brought forth replies ranging from enthusiastic yes to equally definite no.

Some of the pro comment:

"Yes—for insertion in renewing old services. Not to be run without casing." This from a medium sized midwestern company.

The chief engineer of a southwestern company said: "Yes, for the purpose of renewing street crossings or services, it is very successful."

A Kansas utility's distribution superintendent likes plastic pipe. He told *GAS*: "Yes, there are savings in total unit costs and in public relations as there is a minimum of damage to customers' lawns and other property (while renewing old services). Plastic also reduces the corrosion problem."

"For inserting in existing services, yes," says the manger of gas engineering for a large midwestern company.

A distribution engineer with a large Rocky Mountain area distribution reports: "We have experienced very satisfactory results in the use of plastic pipe for both direct burial and insert natural gas service piping."

"Yes, especially for inserting in existing steel services across and under paved streets," says the gas superintendent of a Texas utility.

Others had some criticisms.

An official of a Nebraska company says: "The material itself seems to be good, but we have had some trouble with expansion and contraction." He notes, though, that his company will probably install more plastic pipe this year on an experimental basis.

"Not entirely" is the succinct comment of a Minnesota utility official.

"The first we used had thin spots in walls, and would not take pressure rating. We are testing, and have no definite opinion." This comment comes from the assistant general superintendent of a Texas distributor.

Two companies operating in cold climates are concerned over plastic pipe's ability to withstand frost.

The general superintendent of a New England company answers: "Not in our territory where frost gets down to the main." A northern company official told *GAS*: "We have not as yet made any use of plastic pipe. We have been concerned about the use of plastic pipe in the extremely cold climate in which we operate."

Other companies are still on the fence. A West Coast gasman reports: "We think it has merit under some conditions. Depending upon relative costs, we may consider some usage."

A Canadian utility puts it this way: "Tests are being conducted, and we are watching the plastic pipe industry, but we have no immediate plans to start using plastic pipe."

The one big roadblock to more widespread use of plastic is its inability to withstand the elements found in high-Btu manufactured oil gas. As has been the case every year, those companies still sending out manufactured gas are steering clear of plastic. Some have experimented, some have not. But the answer is the same—no.

• Other uses of plastic

The year of 1958 will see a wider introduction of plastic to the gas industry for materials other than pipe.

Arizona Public Service Co. (Phoenix) will use plastic ells, tees, adapters and couplings this year. Another major Arizona gas distributor, Tucson Gas, Electric Light & Power Co., is using Mueller plastic service tees. Tucson Gas' vice president in charge of gas operations, C. H. Webber, had an important hand in the development of this tee.

And, probably most encouraging to exponents of plastics is the information that at least four distribution companies—and maybe more—plan to test new plastic gas meters in '58.

The meters—made by Rockwell Manufacturing Co. —have the same mechanisms as the standard hard case ones. The plastic cases, though, require no painting.

These meters will be field tested in the East, Southwest and West.

Another new use of plastic has been field tested for several months in parts of the East, and may get more widespread use in 1958. This is a plastic-coated steel pipe, called X-Tru-Coat by its manufacturer and developer, Republic Steel's pipe division. Steel pipe ranging from 0.75-in. to 4.50-in. OD is coated at the mill with extruded polyethylene in thicknesses ranging from 0.025-in. up. It is said to be highly resistant to corrosion. (See page 75.)

• Needed: uniform standards

A big hurdle that yet must be cleared is establishment of uniform gas industry standards for plastic pipe.

Quite a bit of groundwork on this has been done by an AGA committee. Its big report was issued in 1956. However, no reports have been made since.

This committee, one member told *GAS*, is still a long, long way from coming up with any concrete

recommendations. This committee, he says, must depend upon utility companies, plastics manufacturers, and the Society of the Plastics Industry for its information.

Right now, most of the development work in plastics is being done by a relatively small number of gas companies. This is hampering setting any overall specifications because conditions vary greatly in different areas.

Another reason for the apparent slowness is the relative newness of plastic pipe. Distribution companies expect pipe to last for 20 or more years. Plastic pipe didn't make its debut in the gas industry until right after the close of World War II—some 13 years ago. No one yet has any actual field data on its life span.

Encouraging, though, is the knowledge that the American Standards Association is now accumulating information on plastic pipe with the purpose of eventually writing standards. This, too, is a long way away. ■

PLASTIC PIPE

Use of plastic tubing to replace services in low pressure system

By H. R. MURPHY and T. R. BOGUMILL
Peoples Gas Light & Coke Co., Chicago

Making up a plastic pipe joint on sidewalk before it is inserted through old steel service. Sleeve and inside of tubing are swabbed with thinner and sleeve coated with cement so the two plastic sections may be joined.

THE Peoples Gas Light & Coke Co. has, for over 100 years, supplied gas to a city with a population now exceeding 3.6 million people. We supply this gas through some 1,012,000 meters, using more than a half million services, which are, in turn, supplied by approximately 3900 miles of mains.

All of our gas, during ordinary periods, is straight natural 1000 Btu gas which reaches the Chicago area through large pipelines from the Southwest. This gas, which reaches pressures as high as 750 psig, is reduced to pressures ranging from 8-20 psig and is turned into our medium pressure system which traverses every section of our city. This 8-20 psig pressure is, in turn, stepped down to approximately 6-in. wc pressure, or approximately 0.25 psig. This gas at 6-in. wc pressure is then transmitted through our low pressure system to the street in front of the customer's house where a 1½-in. steel pipe service is tapped into the main, usually 6-in. ID cast iron, and extended into the customer's home to supply his meter and appliances.

All *new* services installed to supply domestic customers are 1½-in. steel. These services are installed by jacking the pipe through the ground with a ditch jack, after digging down to the main; a laborious process which requires a three- or four-man crew practically a full day to complete. These services are usually installed bare, without cathodic protection, and generally without insulating couplings. Naturally, the life of the service depends upon the soil condition and stray currents, but we would estimate that our average useful service life is something over 30 years. As a matter of fact, we have what we call a "50-year service" program whereby we renew services nearing 50 years of age, regardless of their condition. Even at this advanced age many of these services prove to be as serviceable as the day they were installed. On the other hand, we have had services fail in less than two years in "hot" areas.

In the old days, when one of these services did become rusted out, due to either stray currents or galvanic action, it was necessary to pull the old pipe out, using a jack and much arduous labor, and replace the defective pipe by jacking in a new steel pipe.

New section of 1.25-in. plastic tubing is inserted into old 1.50-in. steel service in Chicago.

• New method developed

In 1938, however, a new method of replacing faulty services was developed. A hard-drawn copper tubing was inserted into the old steel service, which func-

tioned then only as a protective sleeve for the copper tubing. Connections were made at the main and inside the building with newly developed brass compression fittings connecting the copper tubing to the system. Our people at this time developed an entirely new mode of service renewals to be used in connection with the copper tubing. They designed and constructed new tools and determined the most efficient manner in which they could be used, ultimately arriving at what is now known throughout the gas industry as the "lxl technique." This technique permits our men to cut-off and clear the old service, replace the fittings at the main and to reconnect the insertion tubing to a main, 3 to 7 ft below the street, through an opening in the pavement only 12 in. square. This new technique saved time in pavement breaking and excavation, as well as paving charges, backfilling time, and customer inconvenience. It was possible, through the use of this tubing insertion renewal method, and the newly developed lxl procedure, to replace an old, leaking service in approximately one-half the time required for the previous onerous removal and renewal by the jacking process.

We benefited in still another manner from this new operation. Since copper occupies a much more desirable position, corrosion-wise, in the electromotive or galvanic series, we replaced a service that had probably failed because of corrosive action with a more inert metal and therefore could look forward to better and longer life per service renewal.

As I mentioned previously, this new manner of service renewal was started in 1938, though it was several years before all the tools were developed, techniques perfected and workers instructed. We were just commencing to fully enjoy the fruits of our labors when Pearl Harbor was attacked. Immediately the supply of copper tubing dried up. Since there was no available substitute, we returned, reluctantly, to our old expensive, time consuming service renewal practice of jacking our faulty services. It was quite disheartening; we had the tools, the fittings and the know-how, but no tubing material.

We embarked on a search for a substitute material at this time, but soon even steel pipe became critical, and as we were stringently limited by a shortage of manpower as to the amount of work we could accomplish, the search for the substitute material lost some of its air of immediacy.

Eventually V-J Day arrived, and shortly thereafter, copper tubing again became available. We energetically plunged into the huge backlog of renewal work accumulated during the war years. Within a short time, we were happily using copper tubing for 90 per cent of our service renewals.

• Copper disappears again

We had just started to come out of the forest when the North Koreans attacked the South Koreans and, again, copper swiftly disappeared into the defense plants. Once more the search for an alternate material was instituted. There had been talk in the trade of a new plastic tubing being used by the Southern California Gas Co. with apparent success. They had developed the tubing some eight years earlier and were enthusiastic about its prospects. Realizing that their experience was not an iron clad assurance that

Shut-in air test is completed on section of plastic pipe before it is inserted into old steel service.

we would experience similar results in our vastly different climate, and with a different type of gas, our company decided, early in 1952, to make a thorough and independent search for the plastic tubing most suitable for *our* purposes.

One of the factors that had to be considered in the investigation was the dissimilarity in the gases distributed. Southern California distributed a dry natural gas while we were, at the time, sending out a 900 Btu mixed gas (we have since converted to straight natural gas) that contained light oils, tars, naphthalene, fogging oils, etc.; the dissimilarity in odorizing agents, the difference in operating pressures and the decided difference in expected ground temperatures. However, like Southern California, we were interested in a material that was flexible under normal operating temperatures, easily made gas-tight in the field, resistant to crushing, high in tensile strength and bursting strength, long lasting and, above all, economically feasible.

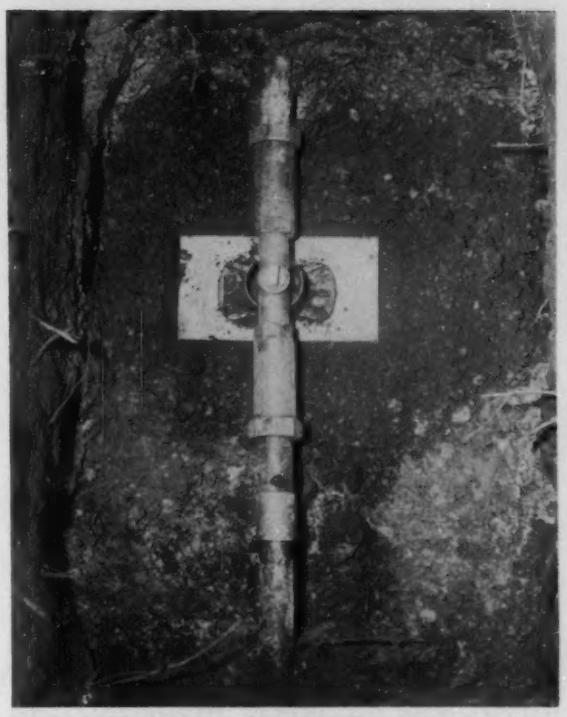
Equipped with these specifications, our research staff went to work.

• Plastic material selected

After adequate investigation, they selected Tenite I and Tenite II from our original group. The Tenite plastics are cheap, easily extruded to a uniform wall thickness, can be readily cemented into gas-tight joints, and are light weight. They retained their elasticity at test temperatures of 70°, 32° and 0° F, and were sufficiently strong to withstand the stresses incurred in installation. Further comparative testing of these two plastics proved that Tenite II had greater strength, and was more resistant to sunlight, acids and alkalies. On the other hand, Tenite I has greater resistance to the solvent action of benzol, alcohol and Captan odorant, which we use to odorize our gases.

The superior strength of Tenite II was very attractive, and because of this, we decided to conduct our own tests as to its resistivity to various possibly detrimental substances. Gases saturated with benzol, fogging oil and butyl mercaptan were passed through sample tubing and, though the concentration of these substances in the sample gas was infinitely greater than that liable to be encountered in actual service, the tubing was completely unaffected. Other accelerated tests of various cantaminants and oils likely to be encountered in our mains were made, and again no detrimental effects were perceived. Thus, after considerable examination and analysis, we finally decided that Tenite II, or cellulose acetate butyrate, was best suited for our particular usage. Our choice coincided with that made eight years earlier by SoCal, who also settled on cellulose acetate butyrate as best suited for *their* needs.

In December 1952 we installed our first plastic tubing service. The tubing was supplied by the Anesite Co. of Chicago, fabricators of Tenite II, which in turn was manufactured by the Tennessee Eastman Co., Kingsport, Tenn., a subsidiary of the Eastman Kodak Co. We selected the tubing in straight 20-ft lengths to be connected by solvent welded internal sleeves, rather than the long rolls of plastic tubing which, we feared, might take a "set" while in storage and thus be undesirable for our purposes. The size, 1.375 in. OD, was determined by our desire to obtain the maximum flow through a tube which could be inserted into our old 1½-in. services, and one that would permit the use of the stock brass compression fittings we used for copper pipe. The use of these compression fittings, however, necessitated the addition of an internal steel sleeve, 6 in. long, for reinforcement wherever a compression fitting was used.



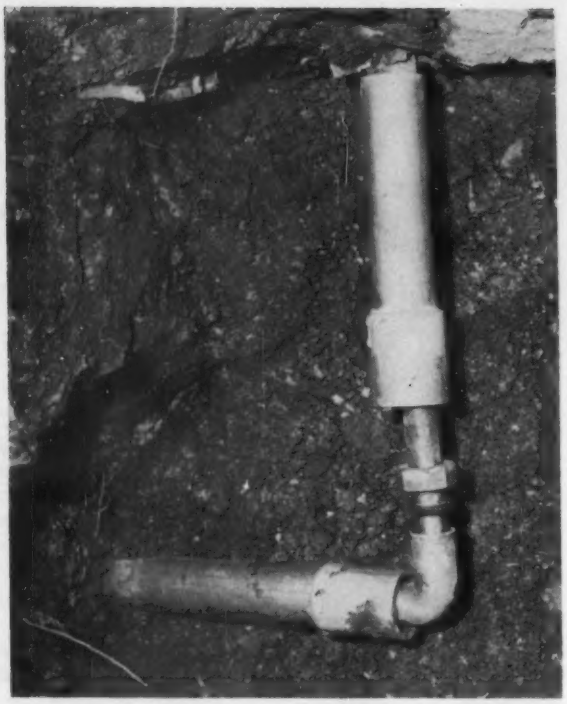
A newly designed 1.50- x 1.25-in. double compression coupling is used on plastic service requiring a cock installation.

This plastic tubing was not a perfect panacea. Like everything else, it had drawbacks. It was not as strong and tough as copper or steel, and it would cut easily should it be struck by a pick or shovel. The plastic service could not be located by use of our pipe locators should the old steel sleeve completely disintegrate. The plastic mars easily and it *did* become necessary to blow the old service out thoroughly and to ream all sharp edges. It *was* affected by the anti-freeze solution, denatured alcohol, we ordinarily employed to unstop frozen services.

• Has many advantages

On the other hand, there were many advantages. In restricted quarters, where formerly it had been necessary to cut the copper tubing into short lengths, forcing the crew to make the installation with many painstaking, time-consuming solder welds, it was found that butyrate bent easily, and frequently could be installed in full 20-ft sections, using quick, simple solvent welds.

These solvent welds are the epitome of speed and



New 1.25-in. double compression brass ell is used on side services. Also shown is impact protector sleeve for plastic pipe.

simplicity. The ends of the tubing to be joined are swabbed out with a solution called a "thinner," which is a combination of methyl ethyl ketone and ethyl acetate, whose function is to clean and soften the inner surface of the tubing. A sleeve, made of the same material as the tubing, only with an OD slightly smaller than the tubing's ID, is coated with cement which is identical to the thinner. The only difference is that butyrate shavings are mixed into the cement solution to give it body. The sleeve is inserted half way into the end of the tube; after approximately 15 seconds, the process is repeated with the other half of the sleeve and in a few seconds you have a completed weld that is as strong as, if not stronger than, the tubing itself.

The high di-electric properties of the plastic serve to effectively insulate the main from stray currents originating in customers' dwellings. The plastic service itself is completely unaffected by galvanic action and the material costs approximately half as much as copper, not to mention substantial savings in labor.

• Used only for inserts

At present, plastic is used for one, and only one, purpose in our system. That application is for insertion renewals of faulty 1½-in. steel, low-pressure services. We do not use bare plastic for new services, as they have in southern California and other localities. We do not, at present, use plastic tubing in our 8-20 psig medium-pressure services; nor do we use plastic in areas where there is a possibility of undue main settlement, or heavy traffic coming in close contact with the service. We do, however, even with all of these restrictions, use butyrate rather extensively. In less than five years we have utilized some 1,250,000 ft of Tenite II to renew approximately 23,000 services. During the last 18 months, plastic was used for 85 per cent of the services renewed.

Our reason for prohibiting the use of plastic in our medium pressure system is not apprehension due to the higher pressures involved. Our laboratory has determined that the bursting pressure of our plastic tubing is approximately 300 psig. Our hesitancy in using plastic on medium services *is* due to the fact that these services incorporate shutoff cocks that are sometimes balky, and we are inclined to believe that the extreme torque sometimes exerted to close these shutoffs might rupture the plastic tubing. Newer fittings and adaptors are now on the market that transfer this torque to the old steel service, rather than the tubing, and we may expand our plastic usage to cover the medium pressure areas in the future.

Our reasons for restricting the use of plastic in areas where there is a possibility of heavy settlement, or where a service would have insufficient cover to withstand the weight of heavy traffic, are obvious. Plastic will elongate sufficiently to withstand ordinary expansion, contraction and settlement stresses, but it will kink and leak when subjected to heavy displacement due to settlement. In the few cases where we have experienced failures in plastic services, however, the settlement was such that any type service, regardless of material, would have failed.

Cold weather also poses problems in the use of butyrate. While we have experienced no difficulty due to cold weather, we do advocate that the tubing be placed inside, in a warm place, when cold weather operations are necessary. Since the tubing is normally installed from the basement, this is generally not difficult to achieve. It is not, however, absolutely necessary that the plastic be shielded from cold weather. It may be readily utilized, even in sub-zero temperatures, provided it is given more considerate handling inasmuch as it does become more brittle, and less flexible, at these lower temperatures.

These restrictions I have mentioned apply to The Peoples Gas Light & Coke Co. of Chicago operations only!

A recent survey of the industry by GAS magazine indicated that at least 15 gas companies in the United States are now using plastic operationally. Some of these companies have even installed plastic mains as large as 3 in. in diameter, as was installed in the city of Avalon, Catalina Island, Calif. The Tucson (Ariz.) Gas, Electric Light & Power Co. has made several 2-in. plastic main installations. One of the installations consisted of 7500 ft in a suburban area, carrying a pressure of 45 psig. This main replaced a wrapped steel main in a "hot" area that only lasted 12 years. Several of the companies use the plastic for new services, installing the plastic unprotected, *but* using care while backfilling. The vast majority of these companies are using Tenite II, cellulose acetate butyrate, although two companies *are* using Kralastic. Pressures used vary from 6-in. wc to as high as 60 psig.

• **Quality check developed**

The American Gas Association, realizing that this new product has much to offer, established a subcommittee on plastic pipe standards late in 1952. This committee has compiled data from those companies utilizing plastics and has published several pamphlets outlining suggested methods, and recommending materials best suited for use in the industry. They have developed several quality control checks to insure consistency in testing materials because they feel that conventional ASTM test methods are not directly applicable to plastic pipe. Peoples Gas has developed its own series of quality checks to insure that newly purchased tubing conforms with our specifications. Our laboratory conducts hardness tests with a Rockwell Hardness-Scale R apparatus to insure that the proper degree of hardness is being received. It also conducts bursting strength tests and impact strength tests, as well as testing new tubing with "Go" and "No Go" gauges and "miking" the walls to insure uniform thickness. It is our belief that some or all of these tests will become ASTM Standards in the near future as a standard of this type is now being evolved.

It is rather ironic that this new material, which we seized upon as an inferior substitute for unavailable copper tubing, has pushed copper to one side and has retained the spotlight on its own merits. During the last 18 months, as mentioned previously, 85 per cent of our service renewals were made with Butyrate. This was accomplished during a period when copper was abundant. The ease of installation, the complete disregard for stray currents or galvanic action, and last, but certainly by no means least, its economy, has made plastic a very effective addition to our stock of items useful in providing the people of Chicago with the type of service to which they are entitled and accustomed. As time passes, and newer methods and materials are developed, it is probable that the significance of plastic tubing will loom larger and larger in our plans for the future, as it will for the entire gas industry. ■

This article has been adapted from a paper presented by the authors at the Oct. 2-4, 1957, meeting of the North Central Region of the National Association of Corrosion Engineers in Chicago. The paper also was abstracted in the NACE publication, "Corrosion," in February 1958.

PERTINENT DATA REGARDING PLASTIC TUBING NOW IN USE AT PEOPLES GAS LIGHT & COKE CO., CHICAGO

Technical Name:	Cellulose Acetate Butyrate
Manufacturer:	Tennessee Eastman Company, Kingsport, Tenn.
Manufacturer's Designation:	Tenite II, Formula 205-S Clear

Tubing Dimensions	**Tubing Tolerances**
1.375″ O.D.	Plus or Minus .007″
.062″ Wall	Plus or Minus .004″
1.251″ I.D.	Plus or Minus .003″
20 Ft. Long	Plus or minus 1 inch

Insert Sleeve Coupling Dimensions	**Tolerances**
1.248″ O.D.	Minus .000″ Plus .006″
.062″ Wall	Plus or Minus .004″
8″ Long	Plus or Minus 1/16″

Physical Properties	
Specific Gravity	1.19
Tensile Strength (Yield @ Room Temp.)	3000 p.s.i.
Impact Strength (Notched 1ZOD @ Room Temp.	3.0 Ft. Lbs/In.
@ 0 Deg. F.	1.5 Ft. Lbs/In.
Compressive Strength (Yield @ Room Temp.)	4300 p.s.i.
Heat Distortion (@ 66 p.s.i.)	150° F.
Burst Strength (Actual Burst) 265-280 p.s.i.	Approx. Calculated Burst 298 p.s.i.

Recommended Working Pressure 20 Per Cent Calculated Burst

Type of Plastic	Thermoplastic
Effect of Alkalies	Unaffected
Effect of Acids	Unaffected

New uses for plastic pipe:

Plastic pipe is pushed through 12-in. main crossing river.

Tubing used for drip pipe in submerged river crossing

By **THOMAS J. LAMBECK, Gas Design & Construction Engineer**
Wisconsin Public Service Corp., Oshkosh, Wis.

IN 1949, about one year prior to the introduction of natural gas into the distribution system of Wisconsin Public Service Corp., the Court street submarine gas main was laid across the Fox river in Oshkosh, Wis. In consists of 1566 ft of 12.75-in. OD wrapped steel pipe commencing at the gas plant on the north bank of the river and terminating at its junction with the 10th street booster main several blocks south of the south river bank.

The submarine portion is about 530 ft long and a 22-in. drip is installed approximately in the center of the river for condensate removal. *Fig. 1* shows the profile of the submarine portion of this crossing. Gas flow is from north to south.

During 1955 there was an occasional indication that condensate from oil fogging and humidifying was accumulating in the crossing. As it could not be removed, we suspected that a sag had developed south of the drip and that it was deep enough to prevent the condensate from flowing back into the drip. A diver examined the crossing in the summer of 1955 but he could determine nothing because of the deep silt bed which had accumulated over the pipe south of the drip. As the trouble at that time was not too serious, nothing further was done that year.

During the winter of 1956-57 there were frequent indications that the condensate accumulation in the river crossing was increasing and that something

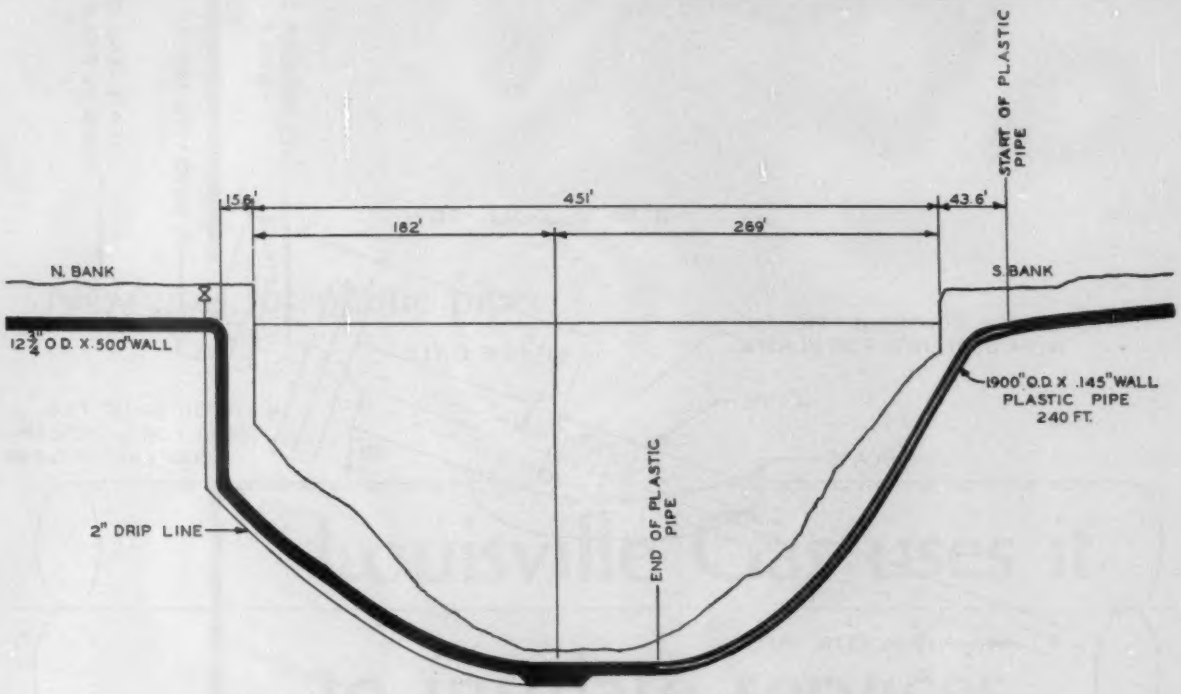


Fig. 1. Profile of Wisconsin Public Service's Court street submarine crossing.

would have to be done during the summer of 1957 to alleviate the condition. The first thought was to jet the pipe from the drip to the south bank to expose it and then to relevel it, using bends or concrete pads. This procedure had been used successfully on other river crossings, but the cost of so doing made us look for an easier and perhaps less expensive way.

After a series of discussions we decided to try to install a 1.5-in. plastic pipe inside of the 12-in. main, starting at the south river bank and pushing it toward the drip until the condensate would be reached. Once this had been done it would be simple to put a drip pump on the end of the plastic and thus remove the condensate.

We were sure we could find a plastic pipe suitable for the job. How to get it inside of the 12-in. was another matter. However, after some experimentation we developed the inserting connection shown in *Figs. 2 and 3*.

On one bright, sunny Saturday morning in October, 1957, the Court street river crossing was valved off and depressured long enough for a welder to install the 4-in. nozzle on the 12-in. pipe. After a suitable cooling period, about 140 ft of 1.5-in. Busada Type 210 transparent butyrate pipe with internal couplings and a 1¼-in. malleable pipe cap (see *Fig. 4*) on the front end was pushed into the 12-in. pipe. The Dresser coupling welded into the 4-in. flange was then tightened and the Telsco coupling with a nipple and a cap was installed on the outside end of the plastic. The submarine crossing was then repressured.

On the following Monday, an additional 100 ft of plastic pipe with a 0.75-in. pump connection was solvent welded to the original 140 ft. This connection was made "hot," for the line pressure was only about 2 psi and the weld was made in less than one minute. Then, with the 0.75-in. cock on the pump end partially opened, the plastic pipe was pushed through the loosened Dresser coupling about 90 ft, at which point the front end of the drip pipe sealed itself off in the condensate. Leakage from the gland of the Dresser coupling was negligible during this operation. A truck-mounted drip tank operating on engine manifold vacuum was then connected and condensate re-

Fig. 2. Closeup of 4-in. inserting connection.

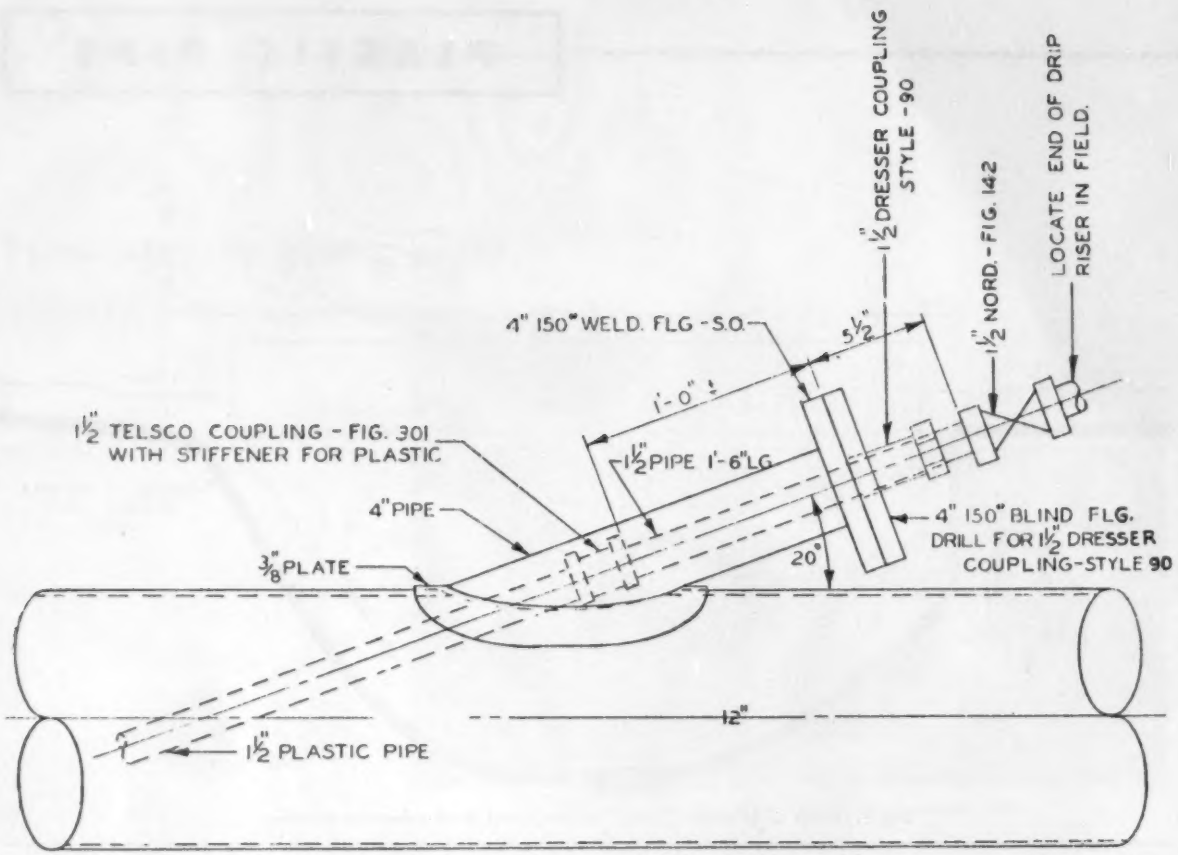

1½" DRESSER COUPLING STYLE -90
1½" NORD. - FIG. 142
LOCATE END OF DRIP RISER IN FIELD.
4" 150" WELD. FLG - S.O.
5½"
1'-0"
1½" TELSCO COUPLING - FIG. 301 WITH STIFFENER FOR PLASTIC
1½" PIPE 1'-6" LG.
4" PIPE
4" 150" BLIND FLG. DRILL FOR 1½" DRESSER COUPLING-STYLE 90
3/8" PLATE
20°
12"
1½" PLASTIC PIPE

Fig. 3. Details of 4-in. inserting connection.

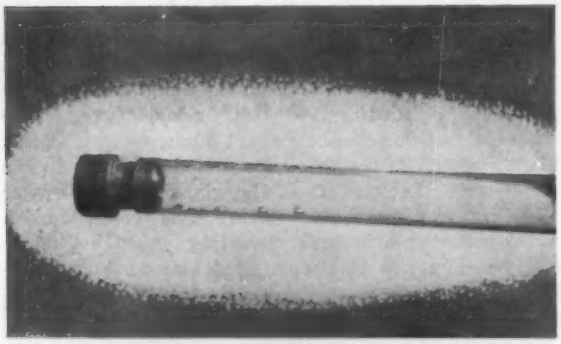


Fig. 4. Closeup of plastic pipe with pipe cap.

moval started. The vacuum developed in the tank was about 15-in. mercury and it was necessary to raise the gas pressure in the line to 9 psi to lift the condensate into the truck tank. The total height for lifting the condensate from the river bottom to the top of the tank is about 30 ft. Two hundred fifty gallons of oil and water were removed before the vacuum broke. The drip pipe was then pushed into the 12-in. gas line another 10 ft, allowing the removal of an additional 100 gal. of condensate.

While we believed that the low point of the sag had been reached, we were not positive; hence, another 20 ft of pipe was welded to the original 240 ft and pushed into the main. We were relieved to find no more condensate.

Since we felt it undesirable, because of location, to allow the plastic pipe to protrude beyond the inserting connection, the river crossing was again valved off and depressured and the final connection made in accordance with the details shown in *Fig. 3*. The last 20 ft of plastic pipe that had been added was removed at this time so that now we have 240 ft completely encased in the 12-in. main. All external connections are steel and the drip riser is mounted above ground. The location of the 1.5-in. plastic pipe inside of the 12-in. submarine pipe is shown in *Fig. 1*. The condensate end of the pipe is only about 50 ft from the south end of the 22-in. drip. This bears out our theory that a sag has developed beyond the drip.

Needless to say, we anticipate no further condensate trouble in this river crossing, for we believe we now have two drip connections, each one serving a portion of the submarine main.

We expect to convert the Court street line from a working pressure of 2 to 10 psi, as it now is, to a pressure of 25 to 30 psi during 1958 or 1959. When the conversion is made the line will carry dry natural gas as we will no longer oil fog or humidify the gas flowing through it. ■

New uses for plastic pipe:

Louisville Gas uses it to insulate services

By R. H. WALTON
Assistant Superintendent, Gas Dept.
Louisville (Ky.) Gas & Electric Co.

GAS exclusive

THE standard gas service installed by our company consists of 1.25-in. nominal diameter steel pipe and the necessary fittings required to extend from the gas main to the customer's property line. All piping within the property is installed and owned by the customer.

During the summer of 1954 it was decided to use plastic pipe on new service installations. Where the gas main and the customer's piping were on the same side of the street the entire service was plastic except for fittings. On a long service crossing street pavement, plastic pipe was used from the customer's piping to the edge of the pavement and the remainder continued to be wrapped steel pipe.

The plastic pipe used was Butyrate with an OD of 1.42-in. and a wall thickness of 0.085 in. The safe working pressure of this pipe at 60°F was 140 psig. This was approximately five times the maximum operating pressure of our distribution system.

Since the plastic in all cases had to be joined at each end to steel, an adapter for plastic-to-steel was required. The adapter we used was made of steel with a male or female IPS thread at one end and a steel enclosed plastic insert at the other. The fitting was screwed to the steel pipe and the plastic pipe was

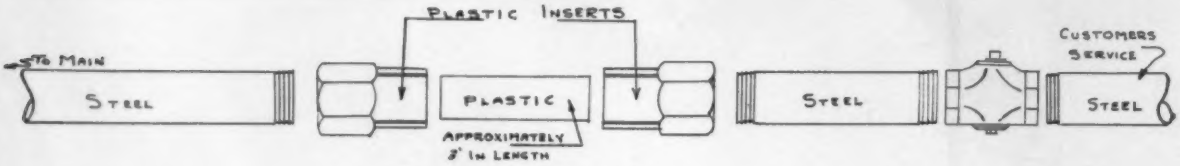


Fig. 1. Plastic-to-steel connection used by Louisville Gas.

solvent welded to the plastic insert of the fitting (*Fig. 1*).

The first services using plastic pipe were installed in October, 1954. Trying to give as much support as possible to the plastic pipe, special attention was given to backfilling around the plastic pipe to give maximum protection during tamping of the remaining backfill.

Even though all services were pressure tested at the time of installation some of these services developed leaks at the solvent weld joint. The first of these leaks were attributed to inexperience; however, after a number were investigated, it was found that the plastic-to-steel adapter had been made in such a manner that a good solvent weld could not be obtained in all cases. Because we were unable to locate a steel-to-plastic adapter which we felt was suitable, the use of plastic pipe was immediately discontinued.

A program of cathodic protection was started later which required that all new services be insulated at the customer's property line. In all but a few cases the insulation desired was obtained with insulating type compression fittings. Investigation of the shorted services disclosed that improper installation of the insulating coupling was the reason for the cathodic protection failure.

In an effort to obtain a foolproof method of insulating services, we decided to use a short piece of plastic, approximately 2 or 3 ft long, on each new service. Again, the problem of a connection between plastic and steel pipe was encountered. Our solution was to again use Butyrate pipe but with compression fittings. This did away with any solvent weld joints, which had caused all our earlier troubles. Our supplier furnished couplings with a standard gasket for 1.25-in. steel pipe in one end and a special gasket for the 1.42-in. OD plastic pipe in the other. We also use an adapter fitting with a male thread on one end and the special gasket for plastic pipe at the other end.

With the use of compression fittings and plastic pipe we found that it was not too difficult to deform the plastic immediately beneath the gasket. After trying various methods of reinforcing the plastic pipe we obtained steel tubing which had an OD only slightly less than the ID of the plastic pipe. This tubing was cut to 4-in. lengths and one end was flared slightly to prevent it from sliding back into the plastic pipe. These steel inserts are used in both ends of the plastic pipe and the compression fittings made tight without deforming the plastic.

A new service now consists of wrapped steel pipe from the main to within 2 or 3 ft of the customer's property line. This 2 or 3 ft is connected with the plastic pipe (*Fig. 2*). Up to the present time, approximately 10,000 services have been satisfactorily installed in this manner. ■

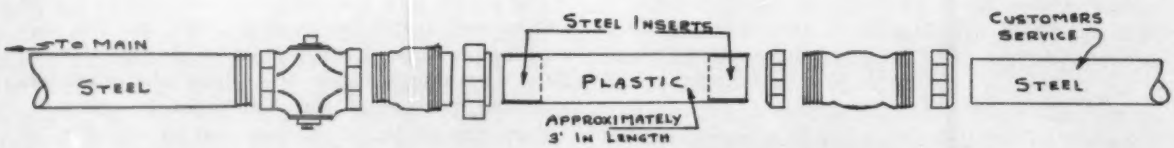


Fig. 2. Drawing shows how plastic pipe is used in new services.

Long term tests with various coating materials

By **HUGO W. WAHLQUIST,** Electrical Engineer, Ebasco Services, Inc., New York

IN 1946 a number of pipe specimens with a variety of test coatings were installed in 600 ohm-cm clay soil at the United Gas Corp. warehouse in Houston, Texas. In these tests it was desired to determine the behavior of commonly used pipeline coatings and coatings that might be used to coat welded joints on mill-wrapped pipe, when continuously subjected to electrical potentials under both anodic and cathodic conditions.

Data accorded during the first 10 years of these tests have now been analyzed. The coatings were applied to 1¼-in. sandblasted steel pipes 30 in. long, the area of coating exposed for test being approximately 1 sq ft per specimen. Although some of these specimens have been removed for inspection and new specimens added, many of the original specimens are still undergoing test after 11 years burial.

Lead-sheathed rubber-insulated test leads from the buried specimens were run to a terminal box (*Fig. 1*) so that current, potential, and coating resistance values could be measured. Generally, at least two specimens of each type of coating were installed. Initially, one set was tied to the negative terminal and the other to the positive terminal of a rectifier. However, the behavior of the coatings under cathodic conditions was of major interest, and most of the data have been obtained with all specimens cathodically protected.

In order to insure that the measured currents are those collected or discharged through the coating, particular care was paid to the preparation of the specimens to avoid leakage at the ends and through the insulation of the connecting wire. The wire used from the specimens to the terminal box consists of lead-covered rubber-insulated wire which measured over 10,000 megohms per lead. Some later installations were made with vinyl insulated TW wire or wire having moisture-resistant rubber insulation with a

Fig. 1. (left). View of terminal box.

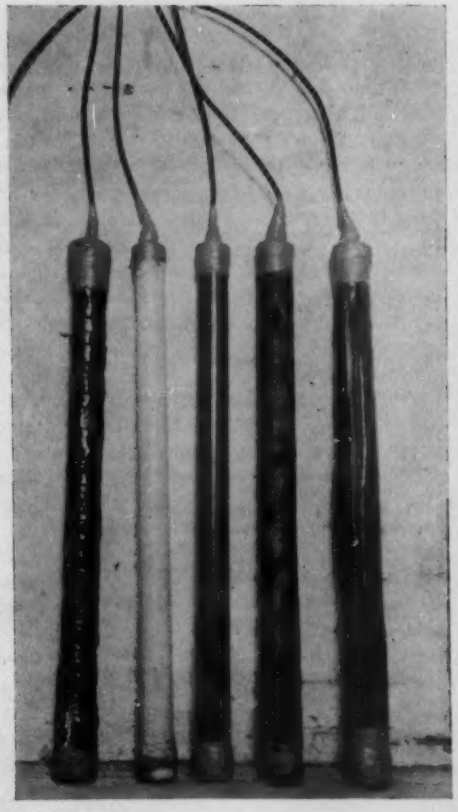


Fig. 2. (right). Examples of specimens prepared for installation at test site.

neoprene jacket. Metal disks were soldered to the ends of the sandblasted pipes and after priming, the ends were dipped several times in hot coal-tar enamel. A brass screw soldered to the metal disc on one end of the pipe is also soldered to the test wire, then thoroughly taped with high-grade self-vulcanizing rubber tape. The enamel on the ends of the pipe was also taped with several layers of rubber tape. (*Fig. 2*)

Initially, the rectifier was adjusted with a low-resistance shunt to give a potential of about —1.7 volts on the negative bus and about +.4 volt on the positive bus, referred to a copper sulphate electrode. At these potentials the currents collected and discharged by the poorer coatings increased rapidly to undesirable values. So after a year's operation, the potentials were reduced to —1.1 volts on the negative bus and about —.3 volt on the positive bus, referred to copper sulphate cell. In 1948, after two years' operation, the negative specimens were disconnected from the rectifier and tied to a zinc anode ground bed, so they would operate below the hydrogen overvoltage potential. This has resulted in a relatively stable potential of —1.0 volt on the negative specimens for the past nine years.

In 1950 the rectifier was taken out of service and the previously anodic specimens were made cathodic by connecting them to the zinc anode ground bed. The over-all range in the potential on the bus since 1950 is —.96 to —1.04 volts.

The potential on the bus to which the specimens are connected has been measured to a copper sulphate electrode approximately 50 ft from the specimens. Since 1950, when all specimens were made cathodic at a bus potential of —1.0 volt, the potential of the individual specimens to an electrode in contact with the coating on the specimen has been essentially the same as the bus potential measured to the fixed remote electrode. This is due to the fact that after several

TABLE 1. CURRENT MEASUREMENTS ON SPECIMENS INSTALLED IN 1946

	"A" CURRENTS COLLECTED BY CATHODIC SPECIMENS Microamperes Per Sq. Foot			*"B" CURRENTS DISCHARGED BY DUPLICATE SPECIMENS ON ANODIC BUS Microamperes Per Sq. Foot*		
	1946 First Year	*2nd Year*	*3rd to 10th Year*	*First Year*	*2nd Year*	*3rd & 4th Years*
Coating Specimen	P/S—1.70	P/S—1.1	P/S—1.0	P/S+.47	P/S—.40	P/S—.32
1. Sand-Blasted Bare Pipe	124,000	9,000	550 363—(5–10 years)	155,000	6,200	(destroyed by corrosion)
2. ½-in. Portland Cement & Sand, 1–2 Mix	45,000	1,900	334 170—(5–10 years)	<50	<50	<50
3. 2-in. Portland Cement & Sand, 1–2 Mix	50,000	5,000	550 175—(5–10 years)	<50	<50	<50
4. Coal Tar Cutback	12,000	310	250—(3–4 years)	19,000	2,100	6,000
5. Coal Tar Cutback & Asbestos Felt	4,300	330	—	1,500	600	—
6. Asphalt Roof Cement	5,700	380	—	20,000	7,000	—
7. Asphalt Roof Cement & Asbestos Felt	18,000	1,100	—	6,700	2,100	—
8. Alkyd Varnish & Asbestos Felt	60,000	11,000	—	81,000	19,000	—
9. Rubber Cement, Glass, Rubber Cement	4,600	370	—	940	2,400	—
10. Cold Grease, Heavy Coat With Glass Tape	650	9	4—(3–8 years)	700	200	620
11. Hot Coal Tar & Asbestos Felt	.4	.8	5	.4	.2	1.1
12. Rubber Cement, Glass, Rubber Cement, Friction Tape, Rubber Cement	130	85	43—(3–4 years)	150	180	500
13. Asphalt Mastic, ½-in. thick	.01—	.01—	.017	.01	.01	.03
14. Reclaimed Rubber Adhesive—40 Mils	.7	20	380	30	80	4,300
15. Rubber Tape 40 Mils + Friction Tape + Alkyd Varnish	.01—	.01—	.01—	.09	.01	.01—
16. Rubber Cement Primer, Rubber Tape 20 Mils, Asbestos Felt	.01—	.01—	.6	.01—	.01—	.01—
17. Rubber Tape, 40 Mils	.01—	.01—	.017	.04	.01—	.05
18. Rubber Tape, 20 Mils + Asbestos Felt	.01—	.01—	6	.2	.01—	.8
19. No. 10 Copper Wire, 55-ft. Long, 600V Code Rubber Insulation	.05	13	98	—	—	—
20. No. 10 Copper Wire, 55-ft. Long, 600V Code Rubber Insulation	(on anodic bus 1st 2 years)		73	.03	7 (collect)	—
21. No. 12 Copper Wire, 36-ft. Long 600V Type-T Vinyl Ins.	.01—	.01—	.01—	—	—	—
22. No. 12 Copper Wire, 36-ft. Long 600V Type-T Vinyl Ins.	(on anodic bus 1st 2 years)		.01—	.01—	.01—	—
23. No. 12 Copper Wire, 54-ft. Long 600V Type-TW Ins.	.01—	.01—	0–1000 (Damaged)	—	—	—
24. No. 12 Copper Wire, 54-ft. Long 600V Type TW Ins.	(on anodic bus 1st 2 years)		.01—	.01—	.01—	—
25. Hot Coal Tar & Asbestos Felt, 10-in. Section Removed and Coated with Rubber Tape, 20 Mils, Asbestos Felt	1,030	28	—	6	2	—

months' operation, many of the specimens (particularly those with low-resistance coatings including the bare pipe) polarized to within a few millivolts of the bus potential. In some of the specimens with high-resistance coatings, the polarized potential is well below the bus potential, the difference being chiefly IR drop in the coating, the IR drop in the soil being negligible. During the first two years when the cathodic bus potential was above the hydrogen overvoltage of steel, the potentials to close electrode on specimens with low-resistance coatings were much less than the bus potential, due to IR drops in the soil.

The results of current measurements on specimens installed in 1946 are shown in *Table 1*. Values under 1A are currents collected by cathodic specimens, and values under 1B are currents discharged by anodic specimens.

Bare Pipe Reference Specimen. The currents collected by sandblasted bare pipe reference (Specimen No. 1) over the 10-year period are of particular interest. The initial current during the first year was 124,000 microamperes (124 milliamperes) per square foot at a bus potential of —1.7 volts referred to copper sulphate electrode. Under these conditions the polarized potential, measured during a momentary open circuit, was about —1.15 volts. The high value of current is accounted for by the high driving potential (1.7 — 1.15 = .55 volt), acting on the low resistance-to-earth (about 5 ohms) of the bare pipe in 600 ohm-cm soil.

During the second year, at a bus potential of —1.1 volts, the current averaged 9000 microamperes per square foot. This large current reduction is due chiefly to the reduced driving potential, the polarized potential being about —1.05 volts, with only a small increase in the resistance-to-earth of the specimen.

During the third to 10th years, with a bus potential of —1.0 volt, a further large decrease in current occurred, averaging 550 microamperes per square foot. Most of the latter change is also due to a decrease in the driving potential, although an increase in the resistance-to-earth of the specimen is a contributing factor. The polarized potential of the bare specimen is within a few millivolts of the —1.0 volt bus potential.

Both the polarized potential and the resistance-to-earth of the specimen vary with changing weather conditions. The average yearly rainfall in Houston is 45 in., but there are occasional periods of several months' duration when rainfall is scanty and the soil dries out to a depth of about 4 ft. Under these conditions, the bare and poorly-coated specimens are subject to depolarizing influences from aeration of the soil, and increases occur in the resistance-to-earth. The pipe specimens are buried in vertical holes drilled to a depth of five feet and backfilled with a mixture of natural clay soil and gypsum. Excavated specimens of the anodic bus show more extensive corrosion on the lower part. (*Fig. 3*)

The bare pipe specimen on the anodic bus, *Table 1B*, discharged high current during the first year at a bus potential of +.47 volt to copper sulphate electrode. The driving potential in this case was also high, since the polarization potential remained a few tenths

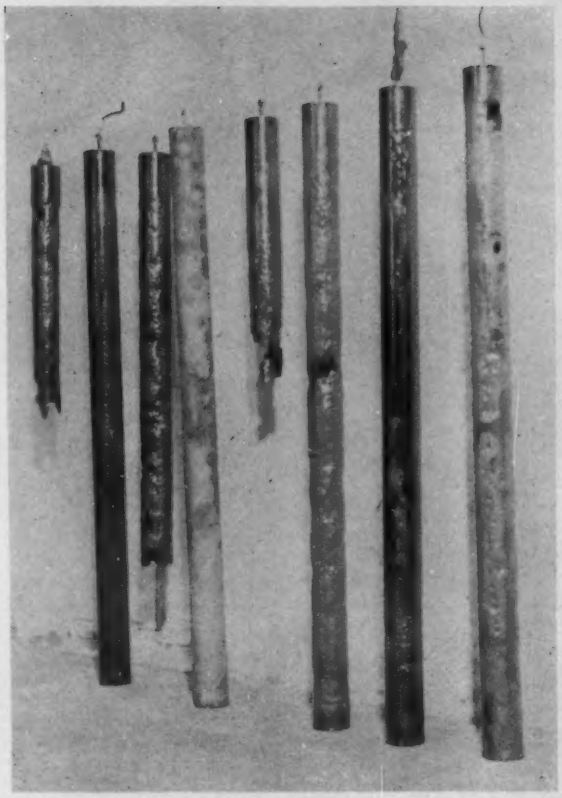


Fig. 3. Specimens excavated after 2 years on anodic bus.

of a volt negative. During the second year, with the bus potential changed to —.40 volt, a large reduction occurred, owing to reduced driving potential and disintegration of the specimen toward the end of the period.

Specimen 1 on *Table 2* shows eight-year data for the bare pipe reference specimen in which the bus potential has remained substantially constant at —1.0 volt to copper sulphate electrode. Data for this specimen are plotted on *Fig. 4*. A steady decrease in current has occurred as thin cathodic scale is formed on the pipe, which allows polarization to approach within a few millivolts of the cathodic bus potential. Some increase in the resistance-to-earth has occurred, but variations in resistance are influenced more by weather conditions than by the cathodic scale, which apparently acts mainly as an oxygen barrier. The pipe-to-soil potential curve on *Fig. 4* is the potential of the cathodic bus during the eight-year period.

Galvanized Pipe. The lower curve on *Fig. 4* shows the behavior of a hot-dipped-galvanized pipe specimen operating continuously at —1.0 volt potential (Specimen 2—*Table 2*). During the first six months the solution potential of the pipe was more negative than the bus potential so that the pipe discharged current (4000 microamperes initially). The solution potential gradually became more positive and after the seventh month the specimen collected current.

Portland Cement and Sand. Specimens 2 and 3 (*Table 1*) were coated with a cement mortar consist-

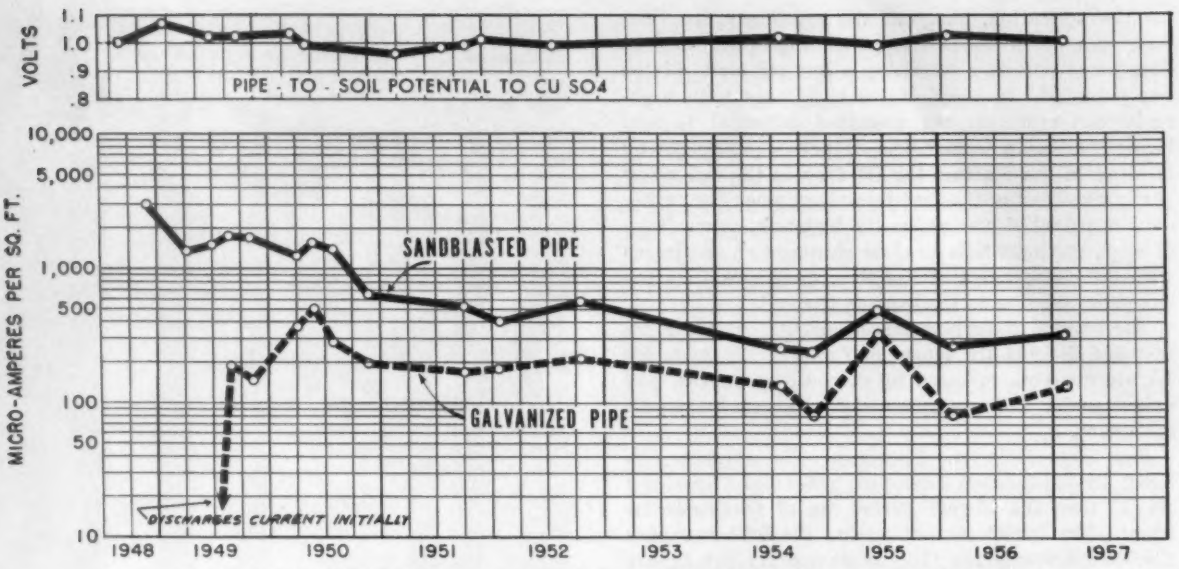


Fig. 4. Current collected by bare pipe in 600-ohm cm soil. Average pipe-to-soil potential, 1.0 v.

ing of one part portland cement and two parts sand. Specimen 2 was cast in a cylindrical form that provided an average coating thickness of ½ in. For Specimen 3 the pipe was centered in a 6-in. diameter hole and cement mortar was poured around it to provide an average thickness of 2 in. The solution potential of the pipes with cement mortar coating measured about —.2 volt initially. The hydrogen overvoltage point appears to be about the same as bare pipe in soil so that large currents were collected by the cathodic specimens during the first year. The initial resistance-to-earth measured about twice that of bare pipe, which accounts for the current being lower than bare pipe. *Fig. 5* shows the current collected by the cement-coated specimens and the potential of the cathodic bus over the 10-year test period. From the measurements obtained, the calculated volume resistivity of the cement increased from 1,670 ohm-cm one month after casting to 6,700 ohm-cm after seven years.

It is in the region of polarization potentials less negative than —1.0 volt that pronounced differences are observed on currents collected or discharged by pipes with cement coatings, as compared with bare pipe. Portland cement coating, although of low resistance, protects steel pipe from corrosion due to polarization of the anodes and cathodes. This is illustrated by the anodic data in *Table B1*.

During the first year, when the bus potential was +.47 volt, the cement-coated specimens discharged negligible current. This is due to anodic polarization

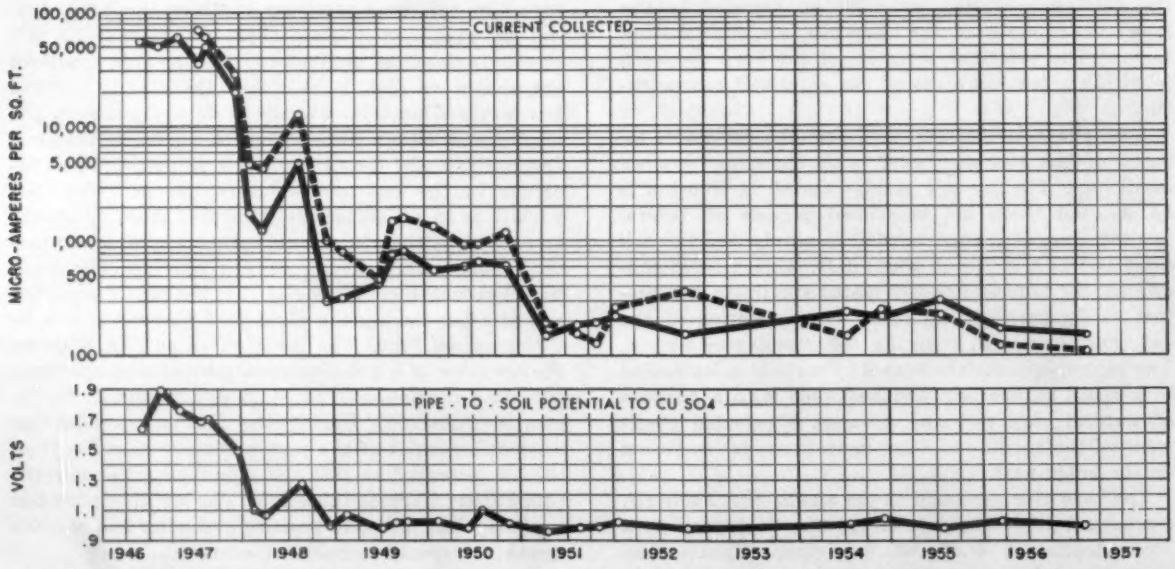


Fig. 5. Steel pipe with concrete coating (mixture, 1 part Portland cement, 2 parts sand). Soil resistivity, 600 ohm cm. Solid line, coating thickness 0.5-in.; dotted line, coating thickness, 2 in.

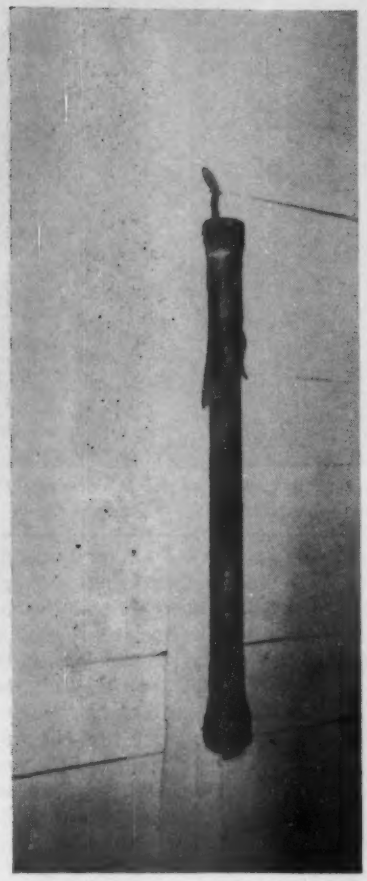


Fig. 6. Disintegration of cold coating from excessive negative potential.

TABLE 2. CURRENTS COLLECTED BY CATHODIC SPECIMENS

Avg. P/S—1.0 Volt CuSO4

Coating Specimen	*Microamperes Per Sq. Foot* 1948 *First Year*	*2nd to 8th Years*
1. Sand-Blasted Bare Pipe	1,850	550 350 (5–8 Years)
2. Galvanized Pipe	— 1,080 (discharge)	174
3. Coal Tar Cutback + Asbestos Felt	185	450 (avg. 2 spec.)
4. Coal Tar Cutback + Asbestos Felt on Wet Coating	130	370 (avg. 2 spec.)
5. Asphalt Cold Coat—.05-in.	16	30 (avg. 2 spec.)
6. Red Lead—2 Coats	1,020	1,400
7. Red Lead—2 Coats + Asbestos Felt	58	455
8. Red Lead—2 Coats + Alkyd-Aluminum—3 Coats	14	245
9. Red Lead—2 Coats + Alkyd Aluminum—3 Coats + Asbestos Felt	38	72
10. Hot Coal Tar + Asbestos Felt	17	8 (buried 14 years)
11. Neoprene .06-in.	3	40 (2–6 Years)
12. Neoprene .06-in.	(on anodic bus 1st 2 years)	20 (3–6 Years)
13. Primer + 2 Coats Vinyl Paint	110	300 (2–6 Years)
14. Primer + 4 Coats Vinyl Paint	.5	3 (2–6 Years)
15. Vinyl Tape—7 Mils + Asbestos Felt	.01—	.3
16. Vinyl Tape—7 Mils + Asbestos Felt	(on anodic bus 1st year)	.01—
17. Vinyl Tape—7 Mils + Asbestos Felt	.01	.03
18. Vinyl Tape—7 Mils	3	2 (2–5 Years)
19. Vinyl Tape—7 Mils	(on anodic bus 1st year)	.5 (2–5 Years)
20. Polyethylene Tape—10 Mils	(on anodic bus 1st year)	1 (2–6 Years)
21. Polyethylene Tape—10 Mils	.01—	.01— (2–6 Years)
22. Polyethylene Tape—10 Mils	3	3 (2–6 Years)
23. Polyethylene Tape—10 Mils	.01—	.01— (2–6 Years)
24. Rubber Tape (20 Mils) + Asbestos Felt	.01—	.05
25. Rubber Tape (20 Mils) 60½-in. Pin Holes	21	31 16 (5–8 Years)
26. Coal Tar Impregnated Canvas Tape	9	40 (avg. 2 spec.)
27. Coal Tar Impregnated Canvas Tape	(on anodic bus 1st 2 years)	390 (avg. 2 spec.)
28. 4/0 Bare Tinned Copper Wire, 10-feet long, 2-feet deep	11,300	11,800
29. 4/0 Bare Copper Wire, 10-feet long, 2-feet deep	12,700	12,400
30. 4/0 Bare Copper Wire, 10-feet long, 8-in. deep	15,000	6,060
31. Grease & Asbestos Felt	340	190
32. Grease & Asbestos Felt	(on anodic bus 1st 2 years)	7,200 (3–6 Years)
33. Hot Coal Tar & Asbestos Felt 2–5-in. Sections Removed and coated with Alkyd Varnish Primer, Rubber Tape 20 Mils, Asbestos Felt	1.5	4
34. Hot Coal Tar & Asbestos Felt 2–5-in. Sections Removed and coated with Alkyd Varnish Primer, Rubber Tape 20 Mils, Asbestos Felt	(on anodic bus 1st 2 years)	15

of the steel, which reduces the driving potential to substantially zero. The pronounced polarization behavior of steel with cement coatings appears to extend from +.6 to —1.0 volt to copper sulphate electrode. Beyond these limits large currents are discharged or collected. Excessive positive potentials cause rust formation and consequent cracking of the cement. Excessive negative potentials cause alkali formation and hydrogen gas on the steel surface, which destroys the bond between the steel and cement.

Measurements of currents less than 50 mca on these specimens were difficult due to erratic fluctuations of the microammeter. Variations in the rectifier supply voltage amounting to a small fraction of 1% were greatly magnified as current surges in the leads to the cement coated specimens. This results from the fact that the polarization builds up slowly, and since the circuit has a resistance of about 10 ohms a one millivolt change in rectifier voltage caused a 100 microampere current surge. Floating a storage battery across the circuit reduced the surges, but did not eliminate them, possibly due to small stray earth currents. The values listed on *Table 1B* as less than 50 mca are conservative estimates of the dc magnitudes.

Insulating Coatings. The general inadequacy of thin paint or varnish coatings on pipelines, and the superior performance of heavy shielded and reinforced asphalt and coal tar enamels and thick asphalt mastic coatings, have been well established by experience. Extensive investigations, such as those reported on by Ewing, Logan, and Scott of coating performance in numerous types of soil established the important criterions for coating performance. In the present test with energized pipes, both good and poor coatings were included. The development of pressure-sensitive plastic films provided additional materials for possible use on pipelines and some early forms of vinyl and polyethylene tapes were included.

The data on *Table 1* show poor performance (high current collected or discharged) for paints and cut

backs, with or without an asbestos felt shield. During the first year when the cathodic bus potential was —1.7 volts, the generation of hydrogen gas and alkali severely damaged these coatings. Damaged coating excavated after two years is shown in *Fig. 6*, and corroded condition of pipes on anodic bus in *Fig. 3*.

The rubber tapes (15-18), asphalt mastic (13), and hot coal tar (11) coatings show extremely small current values for both the cathodic and anodic conditions. The rubber tape is a corona- and moisture-resisting self-vulcanizing natural rubber tape used for insulating joints on high voltage cable. The tape, having a width of 2 in. and thickness of about 30 mils (20 mils applied to pipe), was spiralled on the sand-blasted pipe with 25% overlap, and formed a strong bond with the pipe, either with or without a rubber cement adhesive. The resistance of several of these rubber tape specimens measures several megohms for 1 sq ft after 10 years burial. An example of the use of rubber tape on a gas service tap is shown on *Fig. 7*.

One cold-applied specimen (10) shown in *Table 1*, consisting of a heavy coat of grease wrapped with finely woven glass tape, performed quite well with cathodic energization. The glass tape used consisted of sodium glass, which is somewhat soluble in alkaline soil water. The penetration of grease through the tape coated the fibers and appears to have protected the glass shield. Excavation of this specimen after eight years showed the coating to be excellent.

Another specimen (9) shown in *Table 1*, consisting of sodium glass tape over rubber cement, performed poorly. The high current densities during the first year on the cathodic specimen caused alkali formation that attacked the glass. Excavation of this specimen after two years showed the glass tape had largely disappeared, apparently having dissolved in the alkaline moisture that had developed on the surface of the pipe. The pipe was in perfect condition. Most present-day glass reinforcements use boro-silicate glass, which is more resistant to alkali attack than sodium glass. The glass reinforcement in enamel coatings is largely protected from soil chemicals.

In the analysis shown in *Table 2*, where the cathodic potential averaged —1.0 volt, some of the poorer coatings showed good performance. Specimens 5 and 9, for example, would be expected to fail completely at cathodic potentials —1.7 volts in this low resistivity soil, but are doing well after 8 years at —1.0 volt.

Comparison of specimens 13 and 14 shows the effect of additional film thickness on paint performance. The two extra coats of vinyl paint on specimen 14 resulted in very low collection of current.

All the vinyl and polyethylene tape specimens (15-23) have performed well during the test period. Most of the 7-mil vinyl tapes are an early form of clear film with carbon black pigmented adhesive. This type was found to fail when exposed to sunlight for several months but has performed well underground. Later above-ground installations of black pigmented vinyl film have withstood sunlight several years without failure. Some early polyethylene tapes developed cracks when under tension, but this fault appears to have been overcome in modern tapes.

Specimen 25 is of interest in showing the relatively small effect of numerous pin holes on current collected at potentials below the hydrogen over voltage point, particularly where the coating is alkali-resistant. The rubber tape coating was punctured with a knife blade to produce 60 holidays distributed over the area. Using the two- to eight-year values, the average current per holiday is only one-half microampere. A potential of —1.7 volts applied to this specimen for four days increased the current to 825 mca, or about 30 to 1. This illustrates the large increases that occur in current collected by coatings with holidays when potentials are well above the hydrogen overvoltage point.

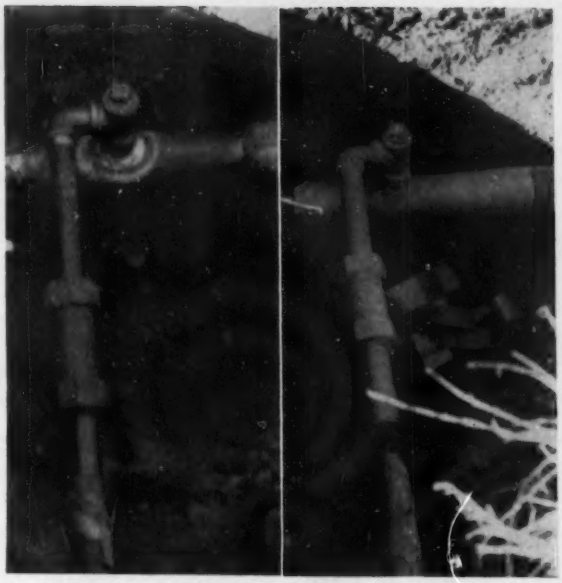


Fig. 7. Use of rubber tape to coat gas service tap at main. At left, before coating; at right, coated with rubber tape.

Specimen 33 is of interest in showing the effectiveness of rubber tape in coating a welded joint of mill-wrapped pipe. The asbestos felt wrapper adjoining the bare section was painted with alkyd varnish to improve the moisture seal. The small current collected indicates this measure was effective. Previous tests (Specimen 25, *Table 1*) had shown accumulation of moisture at the junction of the enamel and pipe on the cathodic specimen. The moisture apparently worked through the asbestos felt by wicking action and electro-osmosis. No corrosion resulted from this moisture penetration. The specimen on the anodic bus was entirely free of moisture.

Specimens 28, 29, and 30 are of interest in showing the current collected by bare copper cable in this low resistivity soil. Specimens 28 and 29 polarize to about —.95 volt and have changed very little in resistance-to-earth. Specimen 30 does not polarize so readily due to its shallow depth, but the resistance-to-earth is substantially higher and is increasing with time, so the collected currents are smaller.

In no case during this investigation where a cathodic specimen has been excavated for inspection has there been a trace of corrosion on the pipe.

The author acknowledges and appreciates the cooperation of the United Gas Corp. in providing facilities for these tests, and the assistance of C. L. Woody of United and my associates in Ebasco.

CORROSION PREVENTION

Plastic coated steel pipe being tested by utilities

A "TWO-IN-ONE" pipe that presents a new approach to the ageless problem of preventing corrosion is currently being tested in the gas industry.

The new product is steel pipe over which is extruded a polyethylene coating to protect it against external corrosion. It is unusual because it is the first steel pipe in the industry to be coated with an extruded plastic at the pipe mill. No special processing is needed after purchase.

Several gas utilities are now testing it.

The pipe's plastic coating is designed to stand off attack of corrosive soils and electrochemical action. The inner core of steel provides the strength needed to handle medium and high pressures.

It is intended for use as buried pipeline and was developed by the pipe division of Republic Steel. Known as Republic X-Tru-Coat, it is being produced in sizes from 0.75-in. to 4.50-in. OD in various wall thicknesses. Coatings of polyethylene range from .025-in. thickness and up.

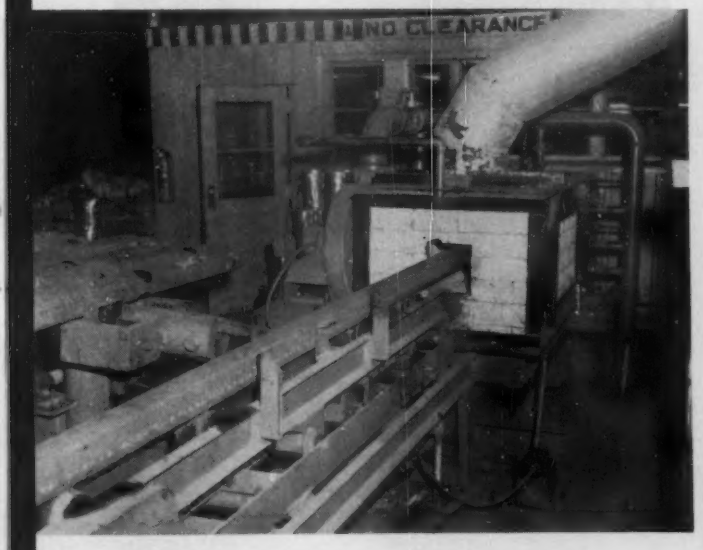
One highly significant characteristic of the pipe is its specially developed "live" elastic undercoating or adhesive which, in the manufacturing process is applied to the steel pipe before the plastic is extruded over it. Because of its chemical composition, this adhesive never sets up or becomes hard and brittle as do most bonding agents. It remains "live" and permits the pipe to be flexed or bent without destroying the bond, according to the manufacturer.

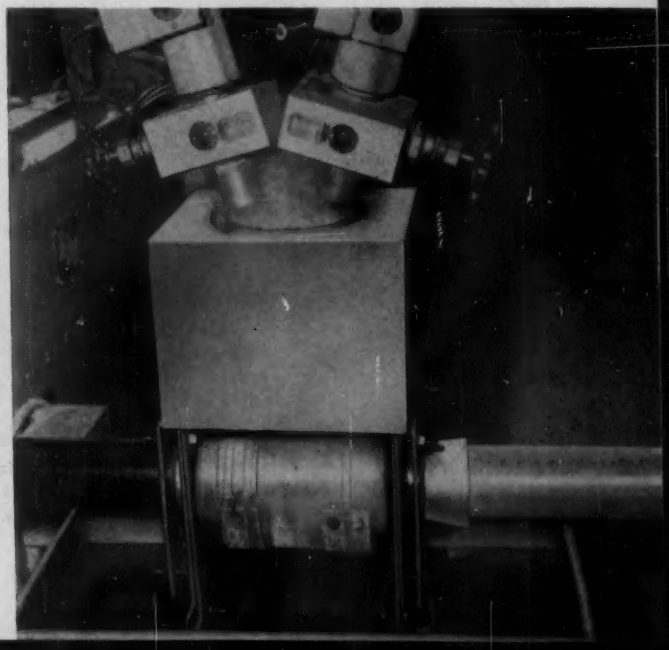
In describing the pipe, company engineers report that the undercoating is unaffected by extreme seasonal temperatures and never loses its ability to seal accidental cuts or abrasions. It also prevents underfilm migration of moisture at the ends of the plastic coating, or in the event of severe coating damage seals off completely the capillary space between the pipe and plastic coating.

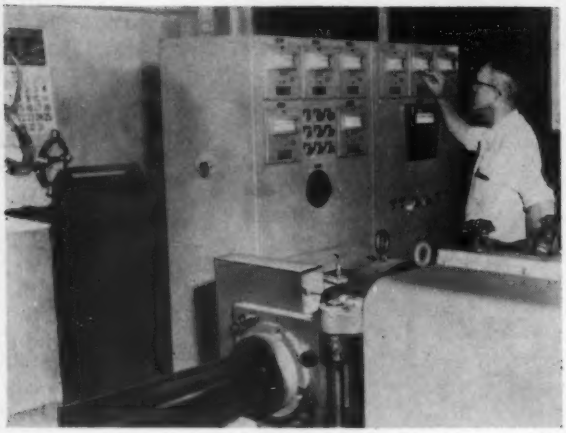
Field joints can be made with regular pressure sensitive tape and primers. In-the-field inspection is made easy because any cuts are apparent to visual inspection.

Another advantage of the pipe cited is the fact

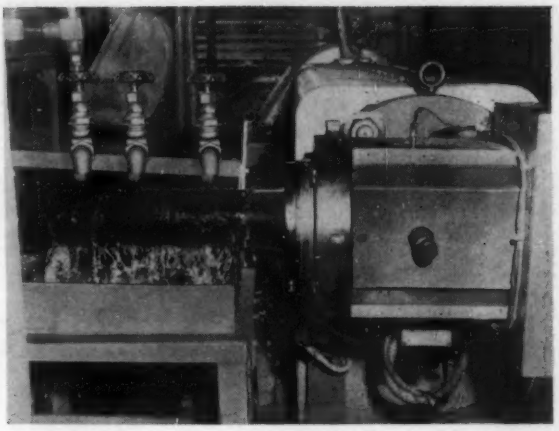
High quality hydrostatically tested steel pipe is cleaned and shot blasted to remove all foreign matter. Then, as shown at left, it is passed through a gas-fired furnace to dry and bring up to control temperature. Pipe is moved automatically along to adhesive undercoating machine (right). Notice the light shade of the pipe as it enters. It exits the other sign coated with adhesive.







Next step (left) is the application of polyethylene. Pipe moves on at right angles through head of the plastic extruding machine.



As the steel pipe emerges from extruding machine (right), the coating cools, causing the plastic to shrink tightly around the pipe.

that it is ready for use the moment it leaves the mill. Appreciable savings in freight costs are possible because the plastic coating of this new pipe weighs only one-fifth as much as ordinary wrapping.

In choosing polyethylene for the coating of its new line of pipe, Republic Steel's pipe division, in addition to its own development work, was able to draw on more than a decade of experience of the company's steel and tubes division. The latter has used polyethylene as a coating to protect welded steel tubing from various kinds of corrosion in chemical plants, paper mills, underground installations, etc.

Physically, polyethylene is one of the most inert plastic materials available. It has exceptionally high chemical resistance and negligible water absorption characteristics. As a material it is tough and flexible as evidenced by its use for many years as a coating for telephone cable. X-Tru-Coat has been given even greater toughness recently by using the new linear type polyethylenes for its outer jacket.

Other basic physical characteristics responsible for the choice of polyethylene as the corrosion armor for plastic coated pipe were: high volume resistivity (low conductance), high dielectric strength, good resistance to weathering, flexibility for bending in the field, ease of repair and resistance to soil stress. ■

The plastic coating is cut back 6-in. for welding in the field. This pipe has been coated with a new linear type polyethylene which is yellow, in contrast to the black coating in other pictures here.

Polyethylene tape is used to wrap the exposed section of pipe after it has been welded. Extruded plastic coating had been stripped back to permit welding.

A method to find shorts in a distribution system

By THOMAS SNEDDEN, Engineer
Northern Illinois Gas Co., Bellwood, Ill.

THE Northern Illinois Gas Co. inaugurated its cathodic protection program as a special activity in 1945. Since then it has installed cathodic protection, mainly with magnesium anodes, to approximately 12 million ft of main, 2 in. to 24 in. and 150,000 services. All new steel pipe installed since 1930 has been coated with 3/32 in. of coal tar enamel. Lately, the coal tar enamel has been reinforced with glass, and all joints and fittings are wrapped with a coal tar tape. For application of cathodic protection, specifications are issued to installed insulating fittings in the new mains to isolate them from the older system or otherwise as designated by the corrosion engineer. All services are electrically isolated from foreign underground piping.

With the volume of work that has been done by Northern Illinois during the expansion period since 1945, the company was bound to experience and find conditions where standards and specifications were overlooked. This is especially true when adhering to the specifications for isolation of services. The axiom of "one rotten apple can spoil a barrel" holds true for a gas distribution system where one shorted service insulator renders the cathodic protection to a large area ineffective. It was also recognized that due to the human element as well as material failure, some method of checking the effectiveness of insulating features was necessary, so a battery test light was secured to accomplish this *(Fig. 1)*. It is found, however, that this is not the foolproof method of testing, in place, an insulating union. The results of a check with a test light will quite frequently indicate a short

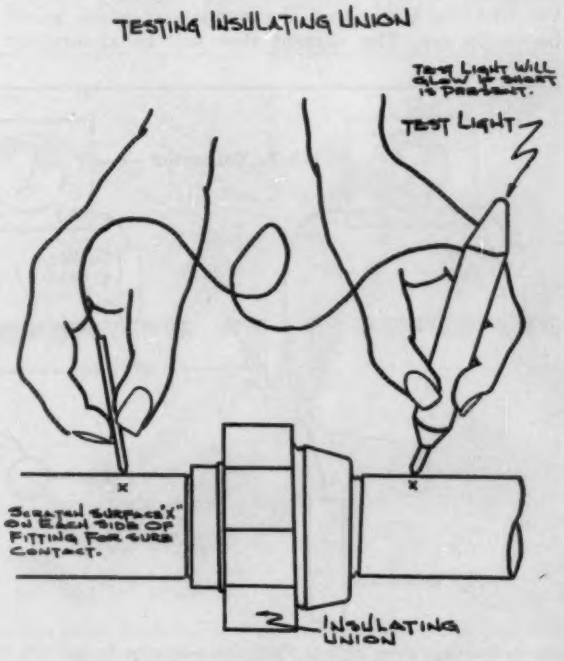

TESTING INSULATING UNION
TEST LIGHT WILL GLOW IF SHORT IS PRESENT.
TEST LIGHT
SCRATCH SURFACE "X" ON EACH SIDE OF FITTING FOR GOOD CONTACT.
X
X
INSULATING UNION

Fig. 1. Testing insulating union.

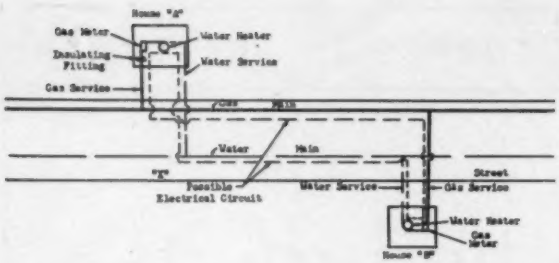


Fig. 2. Electrical resistance test for insulating coupling or union. Condition 1: New service installed in A. B is old residence, with old service without insulating fitting. Insulator in A could erroneously show short by bridging across coupling. Remedies: test insulating fitting with test flashlight before connecting new line or disconnect outlet meter bar union in case of installation of insulating fitting on present service if short is indicated. Replace fitting if short still exists.

when, in reality, it does not exist.

A sheet furnished to the fitters (meter and regulator installers) fully explains how a short can appear but not actually be present at the insulating coupling or union under test *(Fig. 2)*. The sheet also explains the work necessary to make a complete check to confirm the effectiveness of the feature as an insulator.

From an analysis of the cathodic protection installation records (that is, readings of pipe-to-soil potential taken with copper sulfate half cell and a high resistance volt meter, *Fig. 3*), it was found that a large number of sections had pipe-to-soil potential readings lower than accepted. From these readings, it was suspected that couplings or unions were shorted or omitted, as adequate protection had been installed. One or more shorted or omitted insulating union or couplings would so lower the pipe-to-soil potential in two or three blocks that the magnesium anode would be ineffective. The current flow will be abnormally high, reducing the life of the magnesium anode. The anode being so used at an accelerated rate is not the only problem. The main and services between the anodes (if holidays exist) are exposed to corrosion *(Fig. 4)*. If a copper water service crosses either a gas main or service in these unprotected areas, the steel gas main and service is anodic to the copper water service. The loss of ferrous metal results and leaks occur on the gas main or service.

It is quite imperative that sections with cathodic protection be completely isolated; also that the consumption of the magnesium anode be held to the designed limit or current output. *Fig. 4* is a typical isolated and protected section.

It became apparent that some method other than the battery test light was needed for use in suspicious areas where conditions obtained from field test data indicated irregularities. A tester was needed that would fill the following requirements:

1. Check an insulating coupling or union in *place;* that is, without removing it from the associated piping.
2. No calculating necessary, just a meter reading to show if an insulator is good or defective.
3. Simple to operate (no skilled operator necessary).
4. Little or no maintenance.
5. Light in weight.

With this in mind, the author (encouraged by his immediate supervisor, L. E. Nichols) developed a test that would show the actual condition or effectiveness of the insulating fitting *in place* regardless of conditions existing on adjacent services; that is, (shorted or omitted service insulators) or other now influencing factors *(Fig. 2)*.

The above mentioned tester uses the principle of induction of a known impressed a.c. voltage across an insulator. If the insulator is shorted or ineffective, current will be caused to flow on the service pipe. To read this current flow, a clamp-on pick-up coil device was

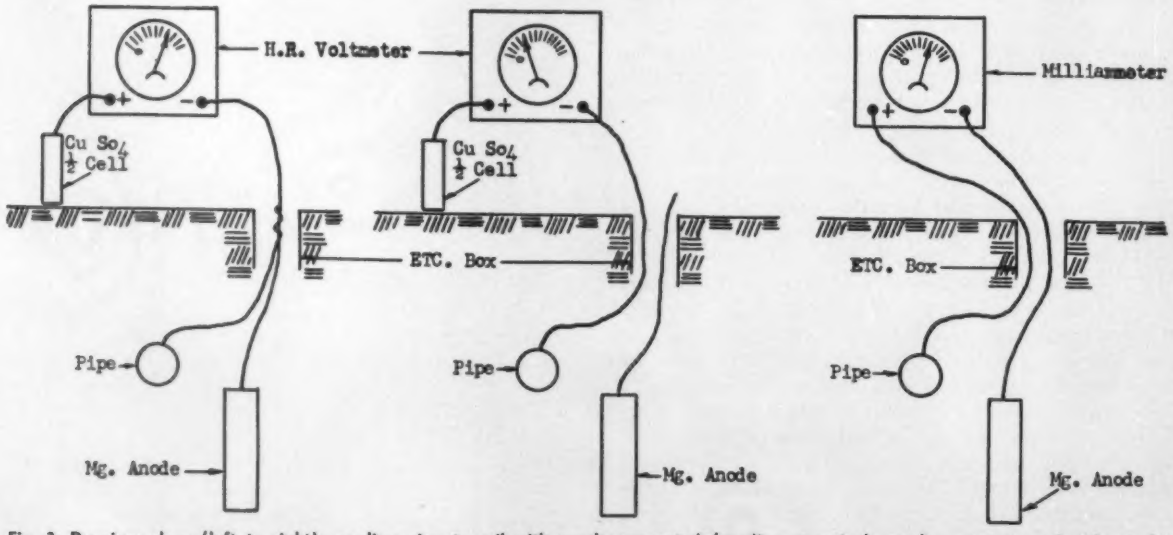
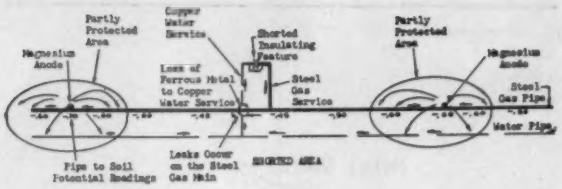


Fig. 3. Drawings show (left to right): reading pipe to soil with anode connected (reading negative); reading pipe to soil with anode disconnected (readings negative); current reading.



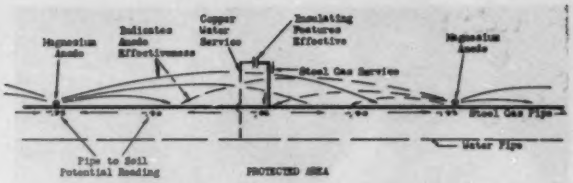


Fig. 4. Shorted area (left): Magnesium anodes are partially protecting small area. Pipe outside area is subject to severe corrosion. Steel gas pipe is positive to copper water service, ferrous metal is lost to copper and leaks occur as shown by arrows. Pipe to soil readings are abnormally low, current high, reducing life of anode. Protected area: Typical condition where pipe and service is protected with magnesium anodes. Condition can be expected after short or omission has been repaired. Pipe to soil and current reading are normal according to good design practice.

used in connection with a transistor current amplifier. A meter was used at the output of the amplifier as an indicator. If the insulator is good, no reading could be obtained. The amount of reading obtained on a shorted insulator is of no importance as it is used only to indicate the presence of current flow *(Fig. 5)*.

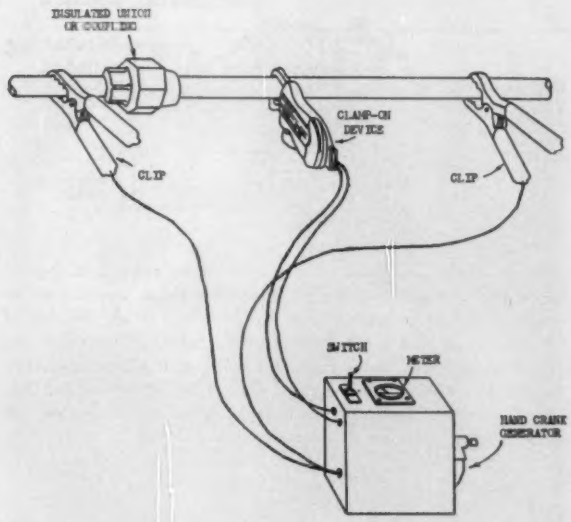
The insulating coupling and union tester was tried out in a comparatively new area. A section of 866 services was checked where the main and services were five years old. This area had adequate magnesium anode protection for the square foot area of main and services, but leaks were widespread *(Fig. 6)*. Shorted insulators were suspected as the pipe-to-soil potential was very low and current flow was high.

To have fitters check each insulator by the old method would require shutting down each customer, disconnecting the fuel line, and checking the insulator with a battery test light, then reconnecting the fuel line, turning on the gas and lighting the appliances. A two-man crew might be able to check about 12 service insulators a day. At this rate, it would have taken them 72 days to check the 866 service insulators. With the tester shown in *Fig. 7*, 866 service insulators were checked in 8 days and 10 shorted and 65 omitted unions or couplings were found.

Two men were used in this test as a matter of convenience, but one man can easily make the test and it is not necessary that he be skilled. There are no calculations to be made from the readings taken; the meter reading is used only to indicate flow or no flow showing the condition of the insulating union or coupling.

Fig. 8 lists possible causes for shorts where accidental or deliberate contact is made at the street side of service insulators.

The three sources of power tried are shown on the left side of *Fig. 9*. The first is a step down transformer connected to 115-v a.c. line. The secondary voltage delivers 10 and this was applied across an insulator. A clamp-on device with a pick-up coil was fashioned from transformer laminations and arranged to be hinged. A germanium crystal was used as a ½ wave rectifier with a d.c. 0-100 microammeter as an indicator *(Fig. 9)*. The 115-v a.c. source was discarded because of the inconvenience of carrying a long extension cord and also having a relay on an a.c. source inside the customer's premises. It was decided this power source



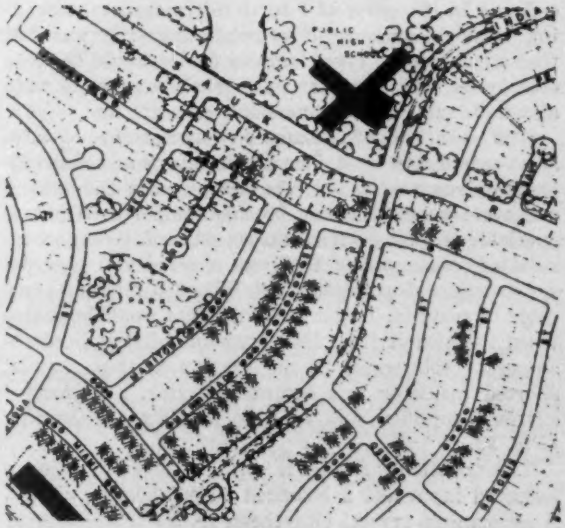


Fig. 5. (left). Diagram shows how to clamp-on pick-up coil device is set up. Fig. 6 (right). Portion of area where insulating unions were either shorted or omitted. Note relationship between shorts and leak areas. Dots show leak on main or service, shaded area shows shorted or omitted insulating union.

Fig. 7. Author Snedden tests an insulating union in place.

would be useless since a large number of our service regulators and insulating unions are installed outside the building; but it proved that the principle of an induced a.c. voltage on a line could be used.

The second source of power tried was a vibrator power supply. This also worked, but the battery maintenance and weight ruled this out *(Fig. 9)*.

A miniature hand crank telephone generator as an a.c. source was next tried *(Fig. 9)*. Its output of 5 watts was connected to the primary of a step-down transformer. The transformer secondary delivered 10-v a.c. If an insulator being tested was shorted and external shorts existed, the amount of current flowing is divided. This is very important and the reason the test light could not be used. The loss in the clamp-on device appeared to be high and the output from the pick-up coil was in the order of 5 to 10 microamperes depending upon the number of external shorts. It was felt that a commercial type clamp-on device would be more efficient so several makes were tried, but results were about the same as the home-made one.

A Weston model 749 clamp-on voltammeter or equivalent was finally used. The meter shunts and multipliers were removed as only the clamp-on and the pick-up coil were needed. About 20 microamperes output is available if only external shorts existed. When an insulating union under test was shorted and external shorts were also present, only about 5 microamperes could be realized. To get a reading that would be usable when the output from the clamp-on coil was 5 microamperes (this would be the worst condition, that is, shorted insulator and external shorts), a transistor current amplifier was used to amplify the reading *(Fig. 9)*.

The transistor circuit is straight forward using a balanced input and a balanced output loading circuit. A germanium crystal (Raytheon 1N294 or equivalent) was used as a ½ wave rectifier with a d.c. 100 microampere meter as the indicator. The transistors used in the amplifier were Raytheon CK766 or equivalent.

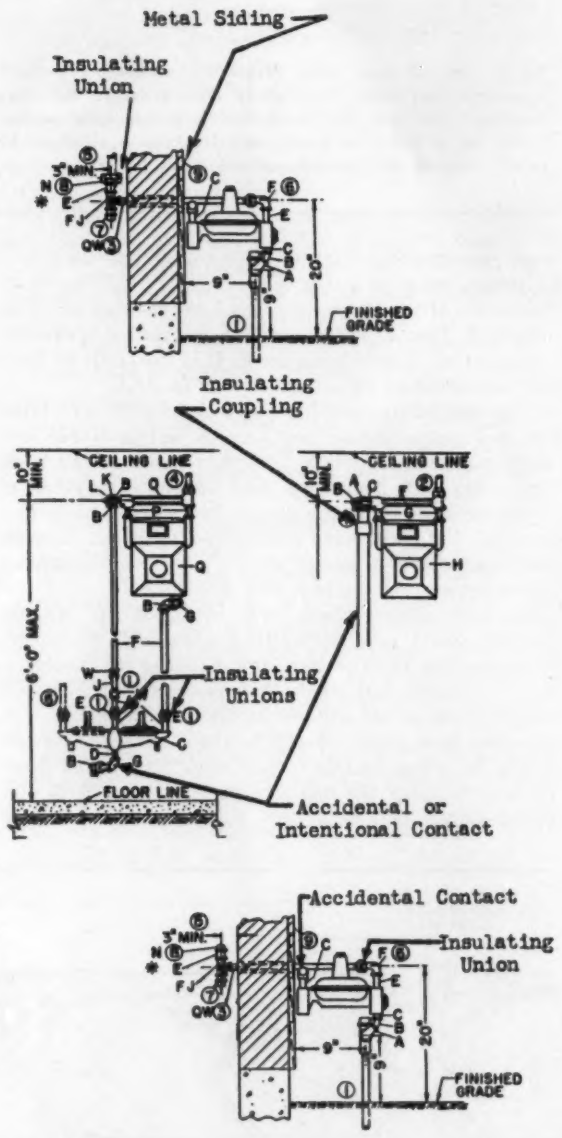


Fig. 8. Shorts can occur other than from an omitted or shorted insulating union or coupling. Top drawing shows service pipe or regulator body in contact with metal siding. It will be shorted if a water sill cock is also touching metal siding. Center drawings show ground wire, water pipe or heating duct either connected or touching service pipe on street side of insulating feature. This, too, will cause short. Bottom drawing: regulator vent pipe will short insulating feature if it touches the fuel line.

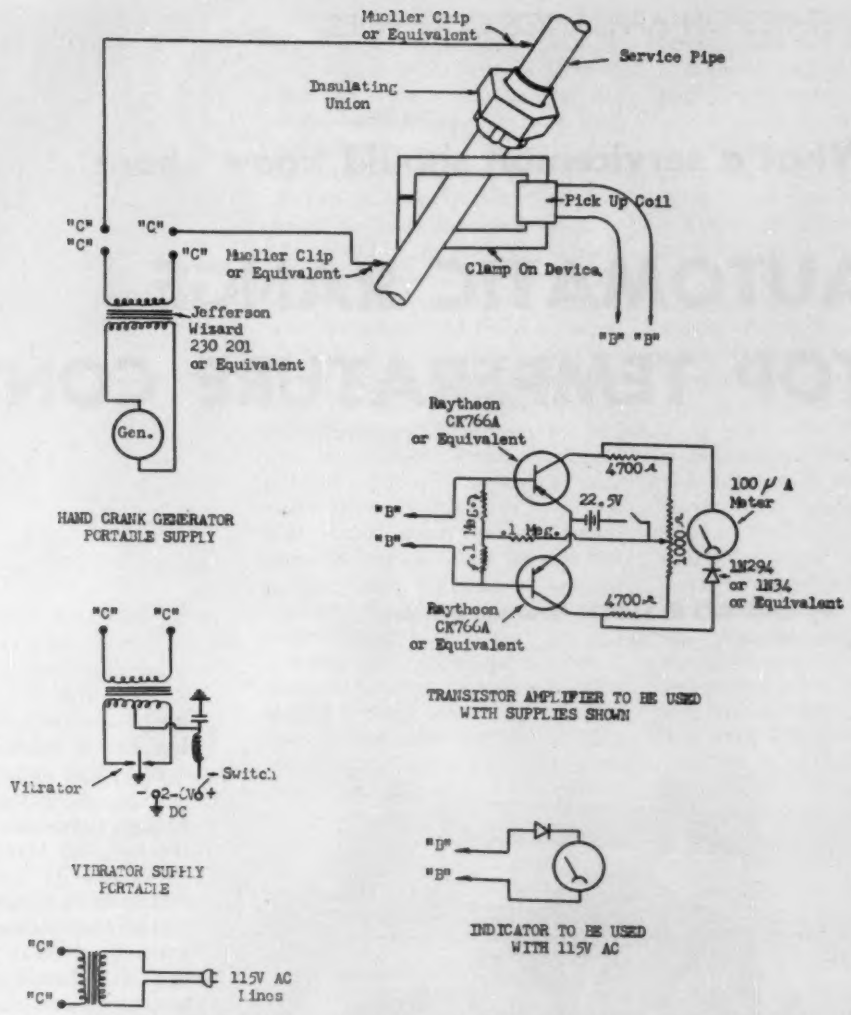


Fig. 9. Insulated union tester. Uses either fixed or portable 115-v a.c. current supply.

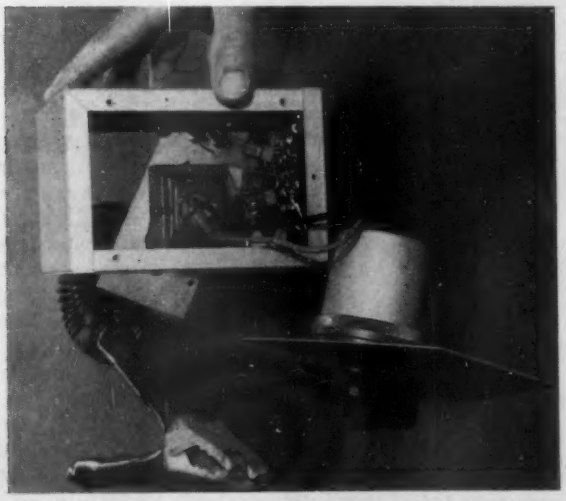


Fig. 10. Closeup view of disassembled tester case. Size is 4-in. x 5-in. x 6-in.

All resistors were ½ watt rating. The battery is a 22½-v and after four months of service, (6-7 hours/day, 5 days per week) the voltage is still over 20 v so the battery consumption is very low. With the development of this tester *(Fig. 10)*, it is now economically possible to check service insulators in suspicious or shorted sections. The Northern Illinois Gas Co. has 25 of these units now in use and the number of tests vary from about 50 to more than 100 a day, depending on the area.

It should be pointed out that this is not a cure-all for shorts encountered on gas distribution systems. It does, however, provide a fast, sure method of checking the effectiveness of a service insulating union or coupling in place where most shorts occur. There is always the possibility of an accidental contact with a foreign structure underground. ■

Corrosion prevention continues in the Pipeline Section, beginning on page 119.

What a serviceman should know about . . .

AUTOMATIC RANGE TOP TEMPERATURE CONTROL

By CHARLES E. SMITH, Grayson Division
Robertshaw-Fulton Controls Co., Youngwood, Pa.

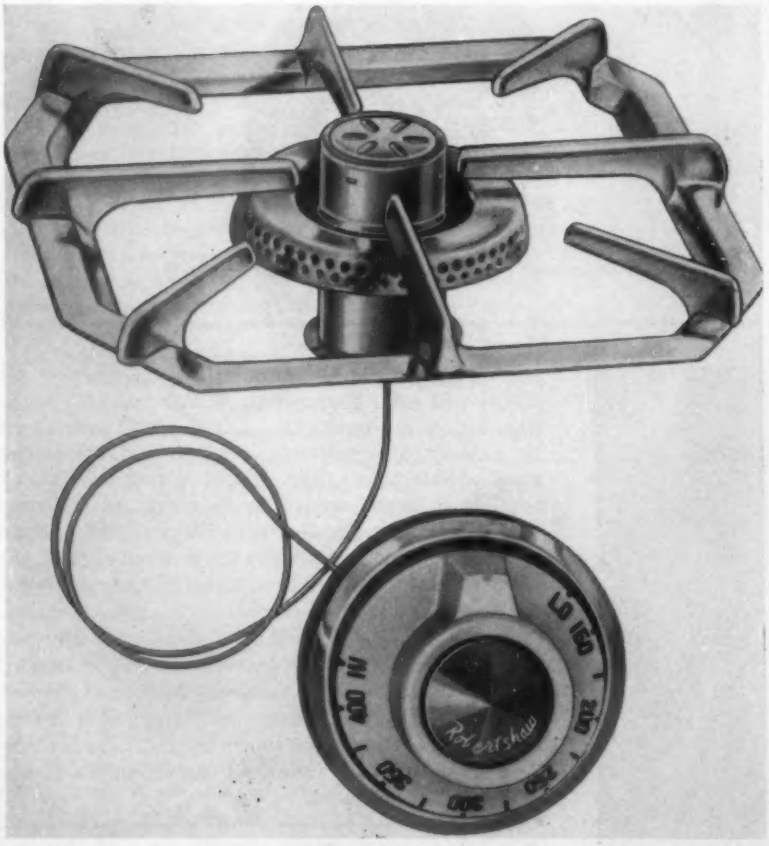


Fig. 1. Sensing element must extend ⅛ in. above grate level and move up and down freely for proper contact with the utensil.

SURFACE heat controls operate on the same principle as other thermostats. Basically it is a device that regulates the flow of heat when the bottom of the cooking utensil reaches that temperature of heat called for by the dial setting. A sensing unit (*Fig. 1*) snuggles against the bottom of the pan and takes the pan's temperature. As soon as the dial temperature is reached by the pan bottom the thermostat reduces the amount of heat applied to the pan. The thermostat continues to keep the pan's temperature at the dialed setting throughout the cooking period.

Good contact between the bottom of the cooking utensil and the sensing head is very important for satisfactory operation. The bottom of the pan must be a flat surface without ridges, bumps or dents that would prevent good contact with the sensing element. All types of utensils will perform equally well after the desired temperature has been reached regardless of the material from which they are made. Due to varying rates of conductivity between utensil material, reaction time may differ slightly.

The sensing element must extend above the grate level by a minimum of ⅛ in. to assure proper contact when the utensil is placed on it (*Fig. 2*). This should be checked carefully as a bent mounting bracket could hold

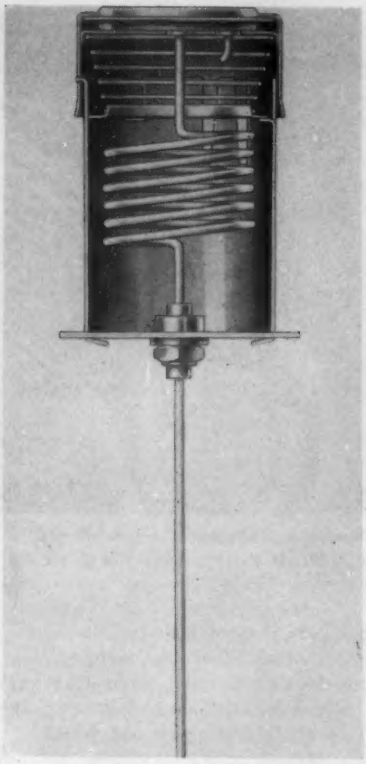


Fig. 2. Sensing element fits tightly against bottom of utensil and regulates flow of heat when pan reaches dial setting.

the sensing head away from the utensil and make the control inoperative.

Food spilled on the sensing element may burn on and act as an insulator if not wiped off. The element surface can normally be cleaned with a damp cloth although it may be necessary to use a cleanser or steel wool to remove burned material.

The sensing wafer must move up and down freely within the can. If it appears to bind or does not center properly, remove the hood of the sensing can, which will allow adjusting the pressure spring and coiled capillary to a more central position. Do not pull the sensing wafer up away from the can and distort the coiled capillary. In replacing the sensing can hood be sure that the small metal tabs which hold it on and also guide its vertical movement are not bent or binding. In general make sure the sensing element extends slightly above the grate and moves up and down freely.

Top temperature controls (*Fig. 3*) are built for various types of ignition and it is quite important when servicing a unit to first determine which type is used and make certain it is properly adjusted before checking further.

When a by-pass flame on the burner is used for ignition it is quite common to find it adjusted too high, which is very serious in trying to control utensil temperature. To adjust the by-pass flame, place a pan of water on the burner and set temperature dial for 175° F. The flame should burn full until temperature setting is reached. Then it should reduce gradually to just a very small bead of flame. If it is too high, turn down until a small flame is seen to flick around the burner, then increase it enough to stop it running around and make it burn steady.

When an independent pilot is used, care must be taken to keep the pilot flame low enough to prevent a hot spot on the utensil, resulting in burning at that point. Also keep the pilot high enough to prevent delayed ignition.

Before recalibrating a control, be sure to check all other points that may possibly cause the trouble. In cases of overheating, check the by-pass flame adjustment, the independent pilot flame, see that the contact surface of the utensil is flat, and that the sensing head is clean and free moving. Then place one quart of water in a three-quart flat bottom sauce pan (covered) and heat with the dial set at 200° F. In about 10 minutes, or after water temperature has leveled out, take a reading with a good thermometer or pyrometer. If temperature is not more than 6° over setting or 10° under setting, do not recalibrate. Should you find it beyond those limits, proceed to recalibrate in accordance with the manufacturer's instructions.

Unnecessary complaints and service calls often are the direct result of the housewife not fully understanding how her new top temperature control should operate. When used with an independent pilot, the food being prepared reaches the dial setting and the flame may go out completely for a short period until it cools enough for the sensing element to call for more heat. Then the burner comes back on very slowly and maintains a small flame. If the housewife did not fully understand this operation she would be concerned upon finding the flame out on the burner and may decide the unit was not operating properly when actually it was doing exactly as intended.

In some controls an adjustable flow mechanism is built in. This allows the user to adjust the maximum volume of gas to the burner to suit each cooking operation by means of a small dial in the center of the main dial. It is important that the homemaker be fully instructed in the use of this feature. ■

Next month's subject will be: What the gas serviceman should know about water heater controls.

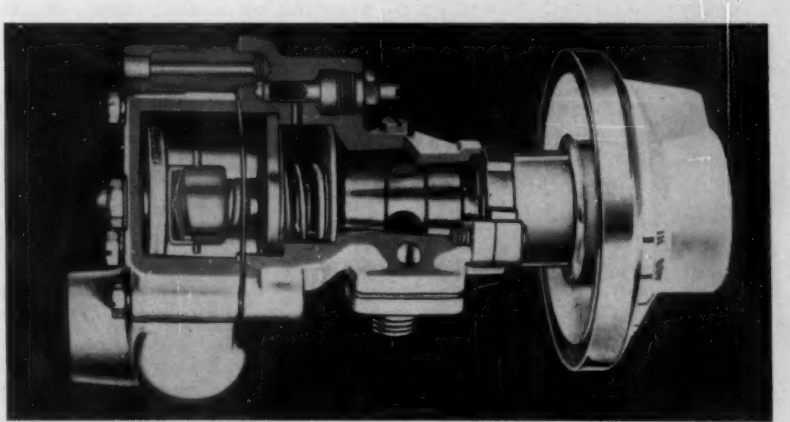


Fig. 3. Surface heat controls operate on the same principle as other thermostats to regulate flow of heat when the bottom of the pan reaches a preset temperature.

Gray sees bright future for gas refrigerator

Whirlpool's Elisha Gray II (center) is questioned about the future of gas refrigeration by GAS' managing editor Don Wright (left) and assistant editor, Barbara Hall (right).

By DON WRIGHT • Managing Editor

GAS-FIRED appliances present the potentially brightest spot in the appliance sales picture of the future, Elisha Gray II, president of Whirlpool Corp., told GAS

Mr. Gray heads the company that suddenly, through its purchase of Servel's gas refrigerator division, has leaped into prominence throughout the gas industry.

Gas appliances haven't received the attention they should have in the past, the Whirlpool president feels. He indicated that his company, for one, will do something about this in the future.

As an example, he outlined a three-step program for gas refrigerators.

Step 1: Get a gas refrigerator back on the market. This will happen soon—probably by mid-April. The first ones will be similar to the last Servel refrigerator (whose patents and Evansville, Ind., plant Whirlpool bought in January for $6.5 million). Some 15 changes, mainly in decor, will be made. It will be sold under the name RCA-Whirlpool.

Step 2: Interim improvement on the gas refrigeration system, and adaptation of the gas-fired unit to the same cabinet that houses the company's electric models. This, Mr. Gray feels, will "take about a year."

Step 3: Development of a superior absorption system which will perform with more efficiency. To this end, Whirlpool expects to spend about $500,000 yearly on research.

Mr. Gray feels that Whirlpool, as a maker of both gas and electric refrigerators, is in a position to offer a superior gas product. Here are his reasons:

It costs between $4.5 and $5 million to tool for production of a new line. About 90 per cent of this is spent for the cabinets—the fuel element is a very small percentage of the total engineering job.

Whirlpool will, in the future, use the same cabinet for both gas and electric models. Thus, the re-tooling costs can be split between the two. The refrigerators will be engineered on a dual basis, and the power pack added.

Company engineers are now working on an absorption unit which will fit into the same cabinet as the electric-powered unit.

Mr. Gray also revealed to GAS that Whirlpool is making a strong entry into the gas appliance field. They've marketed gas ranges and gas dryers for many years. Now, they have the gas refrigerator. And, before the end of this year, an RCA-Whirlpool gas water heater will be on the market.

With the addition of the refrigerator, it also makes possible the first all-gas kitchen from a single manufacturer.

The new RCA-Whirlpool gas refrigerators will be distributed through the regular Whirlpool Corp. distributors, Mr. Gray said. This, he indicated, will give the refrigerator nation-wide distribution through long established channels. ■

What does the homemaker want?

THE exacting and growing demands of the modern homemaker will be heeded by Whirlpool Corp. when it designs its first all-new gas refrigerator.

President Elisha Gray II said his company first wants to get the refrigerator into production. But these first models too will get a revamping. Some 15 changes are to be included. Among these are better crisping bins and new door design.

One of the major changes in the all-new models—expected in a year—will be the redesigned interior, featuring innovations in shelving to give greater flexibility.

—Barbara Hall
Assistant Editor

Smokeless, odorless incinerators introduced

NEW smokeless-odorless models of household gas incinerators are being put into production by seven manufacturers who foresee wide gains for the appliance in many areas of the country, including some sections where gas incinerators now are little used.

The new models have passed, or are undergoing, final tests, under the revised approval standard set by the American Gas Association Approval Requirements Committee and made effective Jan. 1.

Keen utility interest in the new models is reported by the gas incinerator division of the Gas Appliance Manufacturers Association, which conducted an unusual introduction demonstration at Chicago's Sheraton-Blackstone Hotel on Jan. 20. The event, timed to coincide with the National Association of Home Builders show, included the burning of a 7-lb assortment of food waste and trash in one of the smokeless-odorless incinerators.

The demonstration was arranged so that visitors could witness for themselves how the gas flame destroys smoke and odors.

Harold Massey, GAMA managing director presiding at the session, called the incinerator "a tremendous convenience which, coupled with elimination of smoke, odor and fly ash nuisances, is going to reach many more families and communities.

"We are well aware," he said, "that, because of concern over air pollution, public officials, and also the builders and householders who are our prospective customers, will want to see and sniff for themselves.

"This is the sort of situation in which you can't fool any of the people, any of the time. If the product weren't right, then the long and difficult and expensive development process behind it would be wrong. The many tests that have been conducted by manufacturers, in outside laboratories and by gas utilities permit us to be confident that the product is right, and that the ingenuity and splendid engineering behind it will have a chance to prove themselves."

Massey pointed out that incinerator manufacturers, gas utilities and their associations worked together in the development, and that equipment and material suppliers have had a helpful role. Problems of refuse disposal in many areas, and the growing amount of paper packaging and other combustibles generated in homes today, indicate that "the gas industry once again has come up with the right new product at the right time," he said.

The companies that participated in the demonstration and now are putting new smokeless-odorless models into production are Bowser Inc., Chicago; Calcinator Corp., Bay City, Mich.; Caloric Appliance Corp., Topton, Pa.; Locke Stove Co., Kansas City, Mo.; the Majestic Co., Inc., Huntington, Ind.; the

Series of photos dramatized the principle of the new smokeless-odorless gas incinerators. Smoke rising from cigarette in top photo is burned by match in the second photo. This, GAMA officials explained in the Chicago demonstration, illustrates the after-burner principle used in the new incinerators. Photo-diagram at bottom shows garbage being consumed in chamber (1) while multiflame torch burner simultaneously distributes flame and heat to chambers (2) and (3). Course of the products of combustion is indicated by arrows. By the time vent at upper right is reached, smoke and odors have been completely destroyed.

Martin Stamping & Stove Co., Huntsville, Ala., and the Waste King Corp., Los Angeles.

The various makes differ considerably in design, but all use what might be called a "double burning," or even "triple burning" technique. After the first stage of combustion, the waste gases are mixed with air, subjected to heat and flame and rendered inoffensive as they themselves are burned.

Interiors of some models are compartmented in such a way as to use flame from the same burner for disintegrating refuse and destroying smoke and odors. Others employ a separate after-burner. Typical capacity is about one and a half bushels. Controls to shut off the flow of gas should the pilot light be extinguished and insulation of glass fiber and metal foil are employed.

Timer controls turn the incinerator off after a pre-set operating period, usually an hour or two. Most models will sell in the vicinity of $175 to $200, and manufacturers note there are many areas where typical fuel costs will run a nickel a day or less.

In compactness as well as in convenience of operation, the new smokeless-odorless incinerators retain the advantages of earlier models. They are counter height of 36 in. or less and about 22 in. wide.

White and a number of light color finishes are available, with some models offering a choice of tint.

GAMA points out that incinerators have by far the lowest saturation of any of the items in the gas appliance and equipment "family." A new AGA summary estimates 400,000 in use as against 36 million residential customers using utility gas and liquefied petroleum gas. A considerable portion of the present users are concentrated in a limited number of sections, including the Cleveland and Detroit areas.

Millions of homes, including most of the single-family dwellings that have changed from coal to gas heat, already have chimneys suitable for household gas incinerators, it is pointed out. Where this is not the case, manufacturers will strive to show incinerator prospects how suitable factory-built chimneys may be used. ■

GAS • DISTRIBUTION NEWS

Indiana PSC okays storage plan

Indiana's Public Service Commission has granted Central Indiana Gas Co. authority to develop an underground natural gas storage reservoir in Randolph county.

Also given the green light was the company's plan to begin court proceedings for condemnation of part of the real estate it will need for the storage field. About 25 per cent of the area will have to be acquired through legal action, company officials estimated. Estimated cost of the storage field is $3.6 million.

Company officials say that at least 9500 more space heating customers will be served as a result of the development. The additional gas will be distributed among its customers in parts of Delaware, Madison, Henry, Randolph, Jay, Grant, and Blackford counties, including the cities of Muncie, Anderson and Marion.

Quebec Natural starts Montreal conversion

In a dramatic pre-dawn flaring ceremony, Quebec Natural Gas Corp. recently launched its 250,000-customer conversion program in Montreal. This is the largest conversion project in Canada.

Kenneth B. Lucas, vice president and general manager, reports that 400 specially trained men are working on the 20-week project. The 400-man crew will move through the 38 districts into which the company's service area has been divided. It is estimated that the conversion program represents an investment of some $6 million.

Informing customers about the conversion program was one of the major tasks of Quebec Natural. More than 1 million of the 1.6 million people in the area speak and read French generally to the exclusion of English. While a large part are bi-lingual, thousands speak or read French only.

Prior to beginning conversion work, a bi-lingual booklet was mailed to all 250,000 customers describing the new service and explaining conversion procedures. Bilingual press kits were given out. (The three largest French-language papers have circulations ranging from 235,000 to 283,000 The two leading English-language papers have lesser circulations.) Radio and TV announcements, customer broadsides, door-knob hangers, were all of necessity bilingual.

Col. Maurice Forget (right), president, and Kenneth B. Lucas, vice president and general manager, launch Quebec Natural's conversion program. They ignited the first flare at the first purge point in conversion district No. 1 as the 400-man crew moved into action.

Quebec Natural in its first year of operation was faced with a large work order: The organizing, financing, staffing, setting up and equipping a new and integrated general office and service headquarters were among the objectives accomplished. Another achievement was the construction of a 34-mile, 20-in. and 16-in. distribution header across Montreal island between July and December to be ready ahead of the Trans-Canada gas supply. In setting up the conversion districts, more than 350 sectionalizing valves were installed.

Housewives need more facts on appliances

The report from *McCalls'* Better Living Congress reveals that the American housewife is not always aware of appliance developments already on the market. And, she has some pretty definite ideas about what she wants in her kitchen.

Delegates found that the broiler, as well as the whole range, is the most difficult appliance to clean. Not all were aware of ranges with removable oven linings that are on the market. Suggestions were made that there should be a disposable oven liner as well as a removable one.

What women want most today is a larger, better integrated kitchen planned for a variety of activities: Meals and entertainment; laundry —washing, ironing and drying; accommodation for children's homework; sewing and hobbies; storage space. To fulfill these needs, more built-ins are requested; storage space should be easily accessible and centralized for appliances. And, women would like something done in every part of the kitchen to make it easier to clean. They recommend ranges that would be so designed to collect a minimum of dirt. Suggestions were made to eliminate space beneath refrigerators and between major appliances to ease cleaning problems.

Some women thought that the labor-saving devices required too much labor to keep clean and made constructive suggestions for developments. In addition to the removable and disposable linings, women would like to see wall ovens more efficiently ventilated.

Gas industry honors top home builder

A California builder has won the 1957 Gas Industry Builder Award given in recognition of outstanding contributions to the home building industry.

The award, first of its kind, was presented to Willard Woodrow of Bellflower, Calif. by C. S. Stackpole, managing director of the AGA, during the National Association of Home Builders convention.

Mr. Woodrow was selected by a special committee representing gas utilities throughout the U. S. The award is based on builders' advanced methods of production, use of new materials and equipment, and modern merchandising techniques.

Among the long list of firsts credited to Mr. Woodrow is the use of built-in gas ovens and surface units.

Gas careers await IGT scholarship winners

Illinois Institute of Technology has nine scholarships that will enable chemical and mechanical engineering students to prepare for careers in the gas industry.

Dr. Rex T. Ellington, chairman of the education program at the Institute of Gas Technology, says that the scholarships provide full tuition for four years. They will be awarded to out-of-state students in May.

Five of the awards have been established by IGT through contributions from the gas industry.

Winners will be selected by the following companies from high schools in their areas: East Ohio Gas Co., Cleveland; Brooklyn (N. Y.) Union Gas Co.; Panhandle Eastern Pipeline Co., Kansas City, Mo.; Cincinnati (Ohio) Gas & Electric Co.; Columbia Gas System, in Charleston, W. Va., Pittsburgh, or Columbus, Ohio.

Four scholarships for the same academic plan will be supported directly by Consolidated Natural Gas System, composed of East Ohio Gas Co.; Peoples Natural Gas Co. and New York State Natural Gas Co., both of Pittsburgh; and Hope Natural Gas Co., Clarksburg, W. Va.

New rules for conversion burners published

Basic rules for installing gas conversion burners on home ranges that formerly used liquid or solid fuels are contained in a new American Standard, Z21.38-1958.

Original American Standard on the subject was published in 1951. This new edition represents seven years of testing and trial of the first standard and the newest developments by the gas industry.

The 39-page, illustrated standard is available from Dept. DD-5, American Standards Association, 70 E. 45th St., New York 17, at 25 cents a copy.

Built-ins accounted for 10 per cent of '57 ranges

GAMA reports that built-in models accounted for almost 10 per cent of the gas ranges shipped in 1957. In 1956 they accounted for 7.5 per cent.

Year's total for both built-ins and free-standing models was 1,970,900, down 9.4 per cent from the 1956 figure of 2,176,200. Free-standing ranges totaled 1,775,700 in 1957, down 11.7 per cent from the 2,012,-100 shipped in 1956. The 195,200 built-ins shipped represent a 19 per cent gain over the 164,100 in 1956.

Automatic gas water heaters had their third best year in 1957, when

Piedmont Natural Gas Co. is serving gas to its 50,000th customer, and this 14-kt gold-plated meter marks the installation in Charlotte, N. C. Murray Hitchcock (right center) of American Meter Co., presents the gold meter to Buell G. Duncan, Piedmont president, as Vice President J. J. Sheehan, Measurement Superintendent H. F. Cain, and R. J. Nery, representing the North Carolina PUC, look on.

2,544,500 units were shipped. Although helped by sharp gains in December, water heaters were down 7.9 per cent below 1956 because of declines in the early months of 1957.

Renewed interest shown in Washington storage

Interest is increasing in Washington in the search for underground storage areas.

The state's Department of Natural Resources has asked the Association of Washington Gas Utilities for data on the subject, and Pleasand Valley Gas & Oil Co. began drilling for storage near Chehalis in February.

Howard N. Walters, vice president and general manager of Pleasant Valley, reports that the drilling site "is exceedingly favorable and while there is some suggestion that we may run into production of either oil or gas, our geological consultants . . . think that it is one of the most promising prospects for storage that they have dealt with for a long time."

Mr. Walters suggested that if a favorable storage structure exists, it might be developed through "partnership between interested parties.

AGA publishes new appliance service manual

More than 70 types of gas ranges, water heaters, clothes dryers, and incinerators are covered in the new AGA Gas Appliance Service Manual.

The 540-page installation and servicing manual has 370 illustrations and includes special features dealing with wiring diagrams, circuit checking procedures, single-point ignition, electric ignition, clocks and timers, and automatic top burner heat control.

Workers put finishing touches on a Rockwell #5 large-capacity gas meter outside the company's new Kearney, Neb. plant. The meter is capable of measuring up to 10 Mcf/hr at an operating pressure of 4 oz with increasing capacities at higher pressures.

Old valve hunt launched by Norwalk

An old valve hunt is being backed by Norwalk Valve Co., South Norwalk, Conn. to find the oldest Connelly and Norwalk valve in continuous operation.

The search has been launched by Norwalk to celebrate more than 80 years of manufacturing and servicing gas and air control valves. Awards of $100, $75, $50, and $25 will be presented for information

More than

2 MILLION FEET OF ½ INCH KRALOY SERVICE PIPE

already installed

Since 1945 more than two million feet of one-half inch Kraloy Plastic Pipe has been installed for natural gas service lines. This one-half inch PVC pipe has done a job superior to that of ¾ inch, and larger pipe, when made of other materials.

One-half inch Kraloy PVC Pipe can also supply more than an adequate volume of natural gas to your customers. Kraloy can do this because of its mirror-smooth interior walls which result in an extremely high C factor.

Other Kraloy advantages:

1. Kraloy is permanent—not subject to electrolysis, rot, rust or scale.
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3. Kraloy's lighter weight lets your trucks carry more pipe footage.
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Representatives:
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Subsidiary of the Seamless Rubber Co., a Rexall Drug Co. Subsidiary

leading to the oldest valve.

Connelly valves were first produced in 1876. They were incorporated into the Norwalk line in 1945.

Kansas-Nebraska starts employee award program

Kansas-Nebraska Natural Gas Co. Inc. has started an annual employee awards program in the four-state area in which the company operates.

According to S. D. Whiteman, president of the Hastings, Neb. company, two separate awards will be available to eligible full-time employees each calendar year. One will be offered for outstanding ac-

An apology

Seventeen Massachusetts gas companies donated the McIlroy Fluid Metwork Analyzer to Tufts University, not just the New England Gas & Electric Association Service Corp., as indicated in the January issue of *GAS* (page 99).

The computer was presented to Tufts under a novel cooperative agreement worked out by the 17 participating companies. Tufts and the utilities will share the use of the machine, the university using it in its instruction and research program and the utilities using it for research and the solution of engineering problems.

Participating gas companies are: Boston Gas Co.; these New England Gas & Electric System companies—Cambridge Gas Co., Worcester Gas Light Co. and New Bedford Gas & Edison Light Co.; N. E. Electric System gas division companies — Mystic Valley Gas Co., Central Massachusetts Gas Co., Lawrence Gas Co., Northampton Gas Light Co., North Shore Gas Co., Norwood Gas Co., and Wachusett Gas Co.; Brockton-Taunton Gas Co., Fitchburg Gas & Electric Light Co., Springfield Gas Co., Lynn Gas & Electric Co., Lowell Gas Co., and Buzzards Bay Gas Co.

PARSONS introduces...

It's not much wider than a yardstick...

. . . only 3 feet-8 inches wide, to be exact! What's more, this new 77 is just 5 feet-8 inches "low" with the boom in digging position. It only weighs about 6500 lbs., for convenient trailer-transport from job to job.

Trench depths to 5 feet

Small in size, but big in capacity, Parsons 77 has a work range that will surprise you. It produces from 4.4 inches to 21 lineal feet of trench per minute, in 32 hi-lo digging speed selections. You get trench widths from 6 to 18 inches — *and maximum digging depth of 5 feet!*

The tiny 77 is heavy-duty in every respect. It has positive down-crowd on telescopic ladder boom. Self-cleaning, cast-steel buckets are equipped with Parsons "Tap-In" teeth. Shiftable spoil conveyor is instantly reversible for controlled discharge. Compact and maneuverable, the 77 turns within its own length — each crawler is independently driven, independently braked. Better check what this small utility Trenchliner can do on your service lines, small mains, footings, etc. Ask Parsons distributor for demonstration, or write to us for literature.

Here's a companion-model utility trencher on rubber tires — Parsons 88 Trenchmobile®. It makes self-powered moves over streets, highways, through traffic at 12.6 m.p.h. — digs 8 or 16 inches wide, at depths to 5 feet — Big ladder or wheel-types are also available.

Mail to: PARSONS Company, Newton, Iowa *for literature on new 77 Trenchliner*

NAME..... TITLE.....

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STREET.....

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complishment in the field of public relations beyond the normal course of duties. It will be judged on its promotion of public understanding and acceptance of Kansas-Nebraska and/or the natural gas industry.

The other award will be presented for an outstanding contribution toward the improved efficiency and/or economy in the operation of company business.

The winner in either category will receive a $100 U. S. Savings Bond and an inscribed, framed certificate of achievement.

Burners and ignition covered by bulletin

A new bulletin from the AGA Labs describes research on new designs of gas burners and ignition systems to reduce bulk and improve performance of domestic gas range top sections.

The research work described in Bulletin 76 was done at the laboratories under sponsorship of the committee on domestic gas research.

Design techniques and performance characteristics of a number of small compact, single-duty experimental burners, related range top components, including burner ignition systems, and closed range top burner installations are discussed. The information in the bulletin should be of help in the further development of domestic gas range top burners having improved flexibility for use with various gases, improved performance, ease of operation, and reliability.

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COMBUSTION SAFE-GUARD SYSTEMS . . .

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GAS • News Notes

Northern Illinois Gas Co.'s previously announced $10 million financing is taking the form of an issue of 100,000 shares of $100 par straight preferred stock. The issue will be sold at par through an underwriting group headed by the First Boston Corp. and Glore Forgan & Co.

O'Keefe & Merritt, Los Angeles, has named Western Utilities Supply Co., Seattle, as its distributor in Oregon and Washington.

White-Rodgers Ltd. has opened its new factory in Markham, Ont., Canada, northeast of Toronto. The plant, part of White-Rodgers Canadian expansion program, contains over 18,000 sq ft of space.

Iron Fireman Manufacturing Co., Cleveland, has acquired the Timken Silent Automatic division of Scaife Co., Pittsburgh. The Timken headquarters will be moved to Cleveland and the Timken line of heating equipment will be produced at Iron Fireman's Cleveland plants.

The Columbia Pipe & Supply Co., Chicago, has been named distributor for Ruud Manufacturing Co. in Chicago and 10 northern Illinois counties.

A new sales-service training school has been announced by Schield Bantam Co., Waverly, Iowa. Included in the school are engineering and design features, product application, markets, selling aids and tools. This is the first formal sales-training school offered at the factory by Schield Bantam.

Gough Industries Inc. has been appointed Los Angeles metropolitan area distributor for Utility Appliance Corp. and its Gaffers & Sattler line of home appliances.

Rheem Manufacturing Co. has completed arrangements for making and selling Rheem products in Belgium and Canada. The new agreement calls for manufacture and sale in Canada of Rheem automatic storage water heaters and manufacture and sale in Belgium of Rheem water heaters and inner-protective coatings for steel drums and pails.

Cleveland Heater Co., Cleveland, Ohio, has appointed the Double I Supply Co., Kansas City, Kan., as distributor for Rex automatic water heaters in the Kansas City trading area.

Aluminum Tubing Co., Jacksonville, Fla., has changed its name to Roll-Weld Pipe & Tube Inc. President Jack G. Neupert states that the company's new name is more compatible with steel and stainless steel pipe which are being added to the product line.

Rockwell Manufacturing Co. of Canada Ltd. has purchased a new 50,000-sq ft plant at Guelph, Ont. Rockwell of Canada produces gas meters and regulators as well as several other lines.

This display at Peoples Natural Gas Co. Gateway Center office in Pittsburgh attracted widespread attention in the area. Frank Psensky, shop foreman, made the world globe with the moving gas flame sputnik. Through a battery apparatus, the flame continuously circles the globe, suggesting that gas fuel is a universal favorite.

3 feet of frost...
trench 5 feet deep...
30 inches per minute

CLEVELAND TRENCHERS, like Sunberg Well Company's Model 110 working here on the installation of 38,000 feet of 4-inch main in tough frost digging in DeSoto, Iowa, have *for over 25 years* delivered ***more trench . . . in more places . . . at less cost.***

Clevelands are built by The Pioneers of the Modern Trencher, originators of *every* important trencher design feature. There's a Cleveland for every trenching job and you'll find them working everywhere, giving good *reliable* production on tough jobs as well as easy ones—and doing it for year after year.

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Washington • *Cont'd.*

from page 17)

hope of the pipelines for relief. But the chances at the Capitol are anything but cheering. Although the FPC has served notice that it will back "corrective" legislation in Congress, the indications are that a new fight will result, at least as protracted and bitter as that which has accompanied the efforts to upset the 1954 Phillips decision.

Chances are that several bills, including "the" gas industry bill to upset the Memphis decision, will be introduced this year. Backers of this legislation weren't anxious to have it tied onto the Harris bill for fear that it might stir up a new round of controversy and kill off both.

It's plain that many gas distributors, who have long fought superseding rate increases, will oppose any new legislation to upset the Memphis case. This ruling, for the first time, gives them a comfortable "seat at the bargaining table."

The question is whether gas distributors as a whole will go along with arguments of producers, the pipelines, and FPC Chairman Jerome K. Kuykendall that the decision endangers future gas development and pipeline expansion, and may actually force some pipelines into bankruptcy. This, the argument goes, would hurt distributors and consumers as much as anyone.

In filing for a Supreme Court review, the government argues that pipelines could not wait the "several years" it would take for the FPC to approve higher tariffs under alternatives remaining if the Memphis case is allowed to stand.

"And since the natural gas industry is the sixth largest in the country," the government contends in a court brief, "financial impairment or retrogression of a substantial part of it would adversely affect other segments of the economy," including those that supply pipe, compressors, and other extensive facilities.

"So also, communities which are seeking natural gas for heating and industrial purposes would be injured by their inability to obtain it as a result of the abrupt halt to which many pipeline expansion programs would be brought," the government warns.

For the time being, the FPC will ignore the Memphis case. It will continue accepting new rate filings by pipelines, but place new rate boosts under bond or "equivalent assurance" that refunds will be made if the hikes are later rescinded.

At present, some 23 firms have received rate increases and collected some $203 million under the disputed rate procedures, and another 11 firms have rate requests pending totaling more than $217 million a year.

Financial interests have already indicated that if the Memphis decision stands, and pipelines are in effect forbidden the right to gain higher rates to meet unusually rapid cost increases or for expansion, financing of such projects will become almost impossible.

Independent gas producers, fighting to creep out from under federal

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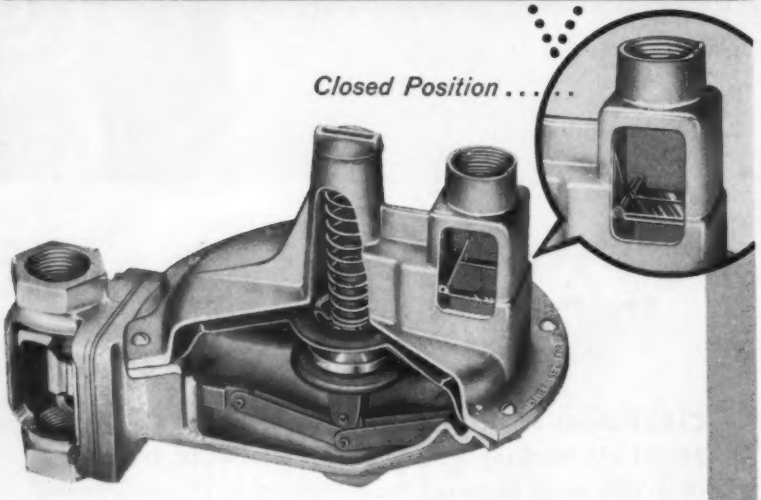

This new Reynolds relief valve has a double action sealing effect which permits the use of a large relief valve orifice which still seals and relieves within close regulation.

An Automatic quick opening flapper for excess pressure gas and yet has standard small vent opening for normal regulation.

The all stainless steel construction flapper valve eliminates high shock-lock off common to other type regulators.

Also available on NRT8010 series No. 1 Model 10, No. 1 Model 20, and No. 1 Model 30 series.

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control through the courts, are having bleak fortunes. The U. S. Supreme Court recently reversed a lower court decision and upset the right of the Kansas Corporation Commission to set minimum prices for gas. Basis of the decision, which was not explained by the court, was apparently that the minimum price "affected" the price of gas in interstate commerce, and thus violated the sole control of the FPC.

Kansas had argued that the minimum was set at the wellhead, before it entered interstate commerce. But the high court flatly rebuffed the State.

The rejection raises the possibility that many pipelines will seek refunds for wellhead prices paid under state minimum price laws, and that eventually distributors too will get refunds. The method by which these refunds could be secured, however, is at present unclear.

Meanwhile, the high court has before it an appeal of a group of independent oil producers contesting a circuit court decision in a case involving Saturn Oil & Gas Co. They contend that the original Phillips decision brought large integrated producers under federal control, but not small producers who sell unprocessed gas.

The chances that this case will bring relief, even though it's the best the producers have, are not considered too good by most legal experts, especially in view of the Kansas case and the indication the court believes the Phillips decision grants the FPC complete jurisdiction over gas pricing.

On another front, the gas industry counted its only apparent victory of the year. With Treasury Secretary Robert B. Anderson backing the principle of percentage depletion before Congress, and the leading congressional tax experts apparently content to do no more than trim back the allowance for brick and clay products, the 27½ per cent oil and gas allowance appears safe. So much so, that oil and gas witnesses who had asked to testify before the House Ways and Means Committee on depletion, withdrew—reserving the right to appear later if the wind suddenly shifted. ■

An important announcement to OEMs...

100% SHUT OFF!

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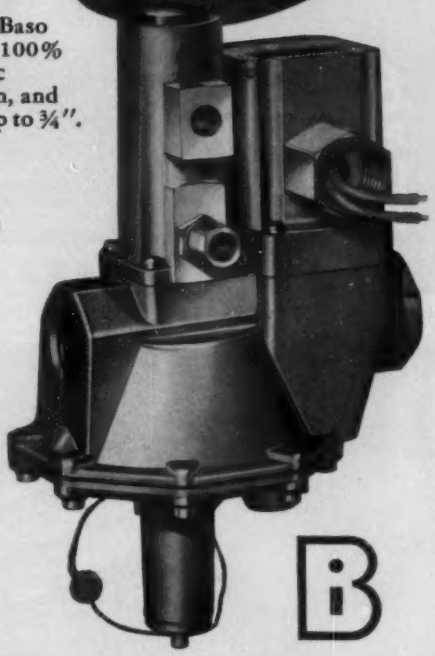
AUTOMATIC PILOT | MAGNETIC VALVE | PRESSURE REGULATOR

New 100% shut off extends even further the usefulness of these compact units. Each retains the Baso automatic pilot (100% or non-100% shut off), the Basotrol magnetic valve for main burner operation, and pressure regulator. Pipe sizes up to ¾".

The Basotrol magnetic valve section is spring loaded, provides strong closing and sealing forces, is quiet, and has a molded rubber valve disc. The valve is available in two voltage types for 115 volt and 20 volt, 60 cycle, a.c.

The reliable Baso automatic pilot is thermocouple operated and prevents gas reaching the main burner during the resetting cycle. The Baso valve snaps closed if the pilot burner should be extinguished, shutting off gas from the main burner.

Both the Basotrol magnetic operator and the Baso automatic pilot assemblies are replaceable in the field.



MODEL	INLET AND OUTLET	OUTLET PRESSURE RANGE		PRESSURE DROP CAPACITY @ 1" W.C.	REGULATION CAPACITY	
		MAX.	MIN.		MAX.	MIN.
GAT*	½" x ⅜"	4"	2"	118,500	116,000	11,600
GAW	½" x ⅜"	4"	2"	118,500	116,000	11,600
GDT	½" x ½"	4"	2"	146,000	145,000	14,500
GDT200*	½" x ½"	4"	2"	146,000	145,000	14,500
GDX4	½" x ½"	4"	2"	177,000	170,000	17,000
GDX4 ( ) 200*	½" x ½"	4"	2"	177,000	170,000	17,000
GDX5	¾" x ¾"	4"	2"	203,000	192,000	19,200
GDX5 ( ) 200*	¾" x ¾"	4"	2"	203,000	192,000	19,200

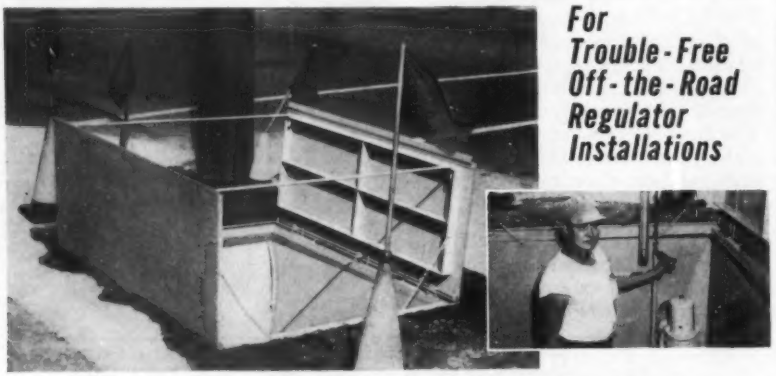
*100% shut off power units.

For more information about Basotrol, *WRITE*

BASO INC.

Dept. SC-2 • MILWAUKEE 1, WISCONSIN

(Formerly Milwaukee Gas Specialty Company)



For Trouble-Free Off-the-Road Regulator Installations

Bilco Sidewalk Doors provide a safe, easy-opening, watertight protective cover!

Because of the rising cost of street vault construction and increasing traffic hazards, gas companies in many cities are now placing their district regulator equipment in "under-the-sidewalk" locations. They're installing Bilco Sidewalk Doors – for the improved ventilation, built-in drainage features, ease of maintenance, durability and all-around safety you'll get when *you* specify Bilco!

Send coupon today for free copy of reprint from Gas Magazine, entitled: "Standardization and Prefabrication of District Regulator Installations"

Bilco®
DOORS FOR SPECIAL SERVICES

The Bilco Co., Dept. 439, New Haven 5, Conn.
Send folder on "Installations" ☐ Send complete Bilco catalog ☐
NAME.....
FIRM.....
ADDRESS.....
CITY..... STATE.....

GAS CALENDAR

March

13-14..Public Utilities Advertising Association—Montreal, Canada.

17-21..National Association of Corrosion Engineers—San Francisco.

20-21..New England Gas Association Annual Meeting—Hotel Statler, Boston.

24-26..Mid-West Gas Association—Broadmoor Hotel, Colorado Springs.

25-27..PCGA Sales & Advertising Section Spring Conference—Harrison Hot Springs, British Columbia.

27-28..Oklahoma Utilities Association Annual Convention—Biltmore Hotel, Oklahoma City.

31-April 2..GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

31-April 2..AGA General Management Section Conference—Washington, D. C.

April

8-10..AGA Sales Conference on Industrial & Commercial Gas—Hotel Schroeder, Milwaukee.

14-16..National Conference of Electric & Gas Utility Accountants—Shamrock-Hilton Hotel, Houston.

15-17..Southwestern Gas Measurement Short Course—University of Oklahoma, North Campus, Norman.

17-18..Indiana Gas Association Annual Meeting—French Lick-Sheraton Hotel, French Lick, Ind.

21-23 AGA Research and Utilization Conference — Hotel Carter, Cleveland, Ohio.

28-30..Southern Gas Association Annual Convention—Dallas.

29-30..PCGA Technical Section Distribution Conference—Tucson, Ariz.

29-May 1..Petroleum Industry Electrical Association Annual Meeting and Exhibit—Baker and Adolphus Hotels, Dallas.

May

5- 9..AGA Distribution, Production, and Transmission Conference—Roosevelt and Commodore Hotels, New York.

6- 7..PCGA Technical Section Transmission Conference—San Diego, Calif.

8- 9..Annual Convention Public Utilities Advertising Association—Penn Sheraton Hotel, Pittsburgh.

Week of May 12..PCGA Sales Section Industrial Gas School—Los Angeles.

12-13..AGA Eastern Gas Sales Conference, Residential Section—Park Sheraton Hotel, New York.

12-19..AGA Mid West Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago.

15..NEGA Operating Division — Sheraton-Biltmore Hotel, Providence, R. I.

19-21..AGA-Mid-West Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago.

20-21..PCGA Technical Section Customer Service Conference — Olympic Hotel, Seattle, Wash.

20-22..Pennsylvania Gas Association Annual Meeting—Pocono Manor Inn, Pocono Manor, Pa.

22-24..Pennsylvania Gas Association Annual Meeting—Pocono Manor Inn, Pocono Manor, Pa.

June

3- 4..AGA-PCGA Joint Domestic Gas Research & Utilization Conference—Ambassador Hotel, Los Angeles.

10-12..3rd Annual Appalachian Underground Corrosion Short Course—West Virginia University, Morgantown, W. Va.

15-19..American Society of Mechanical Engineers—Hotel Statler, Detroit.

23-24..Michigan Gas Association—Grand Hotel, Mackinac Island Mich.

24-27..Canadian Gas Association Annual Meeting—Manoir Richelieu Hotel, Murray Bay, Quebec.

September

2- 4..Pacific Coast Gas Association Annual Convention—Multnomah Hotel, Portland, Oregon.

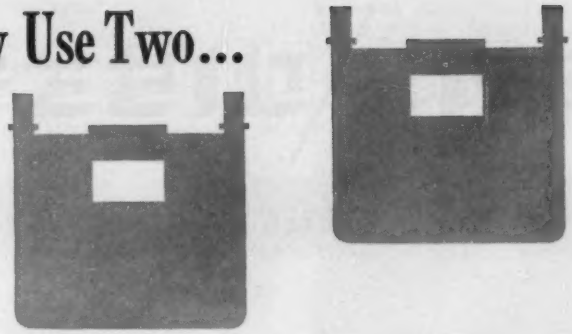
5..New Jersey Gas Association Annual Meeting—Spring Lake, N. J.

22-25..7th International Gas Conference—Rome, Italy.

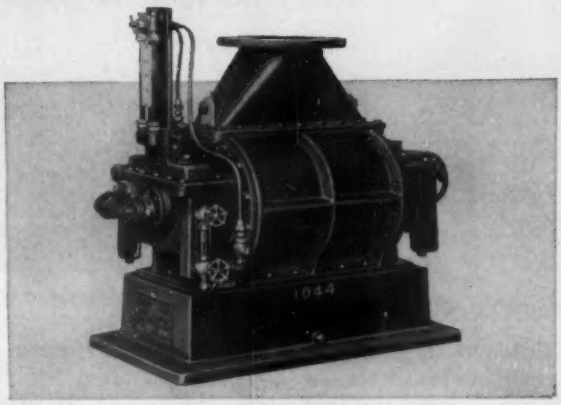
October

13-15..American Gas Association Annual Convention—Atlantic City, N. J.

Why Use Two...



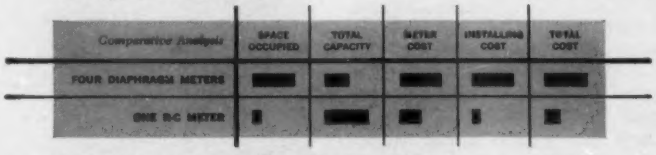
When One Will Do...



Better!

When *one* Roots-Connersville rotary gas meter is used in place of *two* . . . or *three* . . . or *four* of other types, metering costs go down.

This fact has been proved by utility companies and commercial and industrial users of gas everywhere as shown in this typical comparison:



First cost is substantially reduced with the proper selection of the *one* Roots-Connersville meter, from the 39 sizes offered, for a specific requirement. Further savings are made in foundation, piping and installing costs, and in space.

But this is only part of the story. Roots-Connersville gas meters assure unalterable accuracy with far less maintenance than required by other types. There are no valves, valve gear or other small parts to wear out and cause inaccuracies. Servicing is limited to lubrication of bearings and gears and an occasional check of the operating differential.

For additional data, please refer to our section in Chemical Engineering Catalog or Mechanical Catalog or write for descriptive Bulletin M-152.

ROOTS-CONNERSVILLE BLOWER

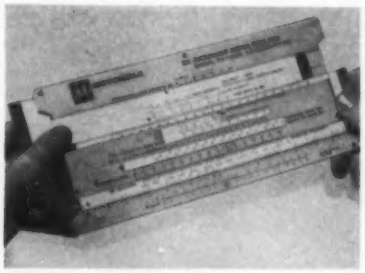
A DIVISION OF DRESSER INDUSTRIES, INC.

358 Oregon Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

GAS DIGEST

New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 99, 100



1. Microwave slide rule

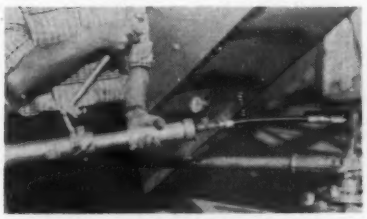
Microwave engineers at Motorola have developed a slide rule that simplifies calculations needed for planning microwave communications systems. Such problems as fading margins, carrier-to-noise ratio, Rayleigh fading probability and many others are solved by the slide rule.
Motorola Inc.

2. Square-look range

The square-look of the 1958 Welbilt range line is achieved by the use of a stainless steel rectangular backguard faced with frosted glass. Featured in the Welbilt line this year are the barbecue-pit rotisserie, convertible to a waist-high second broiler; the Sizzl-Griddle; Kleer-Vue oven windows; Equa-Therm even heat ovens.
Welbilt Corp.

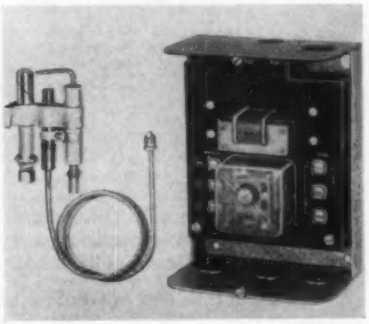
3. Mobile power station

International Harvester's Electrall now is available for use with any make 25-hp or larger tractor. Previously this mobile power station was designed as a V-belt driven, side-mounted unit. Now it may be used as a fast-hitch or trailing model for tractors with ASAE std., 1⅜ diameter, 540 rpm power take-off.
International Harvester



4. Hydraulic handgun

Rockwell's high pressure hydraulic handgun (Model 400-C) is specially designed for plug valve lubrication. The self-priming gun can be used in any position. Because the gun exerts extra-high pressure, the hose and coupler can be locked to the buttonhead fitting in the valve shank. The pressure may be relieved by a turn of the bypass valve on the gun.
Rockwell Manufacturing Co.



5. Flame safety control

General Controls' new R-87 Flame pulse pilot safety control system offers a new concept in flame detection for medium size commercial gas burners. The new combustion safety relay uses two proven principles for positive operation: magnetic amplification coupled with thermoelectric energy.
General Controls Co.

6. Water heaters

A new line of automatic gas water heaters has been added to Temco's list of gas heating appliances. The complete line will consist of 20-, 30- and 40-gal. models in the "Tall Boy" series and 20-, 30-, 40-, and 55-gal. models in the "Shorty" series.
Temco Inc.

7. Hydraulic tailgate

A new elevating tailgate from H. S. Watson mounts underneath a pickup to the truck frame with only four bolts. There are no protrusions or posts above truck body. Mounted on the side of the truck body is a packaged control unit. The Weightlifter powered unit has an 800-lb lifting capacity and is said to lift this load in five seconds.
H. S. Watson Co.

8. Engine analyzer

Internal combustion engine pressures, vibrations and ignition voltages can be measured directly with the SLM engine indicator-analyzer. Kistler's combined electronic pressure indicator and engine analyzer uses the "electrostatic" principle to make precision dynamic measurements. The analyzer may be used for trouble-shooting, diagnosing, monitoring and adjusting high-speed, high-compression engines.
Kistler Instrument Corp.

9. Plug valves

DeZurik valves operate on the eccentric principle — the minute the valve begins to open, the plug lifts away from the seat and opening and closing is accomplished with an easy quarter turn. To insure a dead-tight, drip-tight shut-off, the plug is faced with a resilient material. This also means that the valve never has to be lapped and will seal even when there are solid particles between the seat and the plug.
DeZurik Corp.

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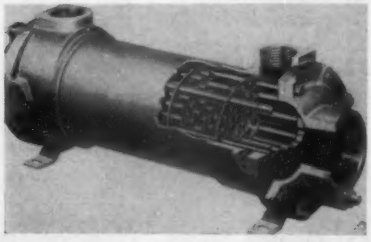
10. Range

Five ways of cooking are offered in Dixie Products Dixiemaster 300 gas range. Featured are four top burners, one with automatic top burner and heat control; cast aluminum griddle; full size oven (with rounded corners for easy cleaning and even heat distribution); a second oven with built-in rotisserie; and a drop-front smokeless broiler.
Dixie Products Inc.

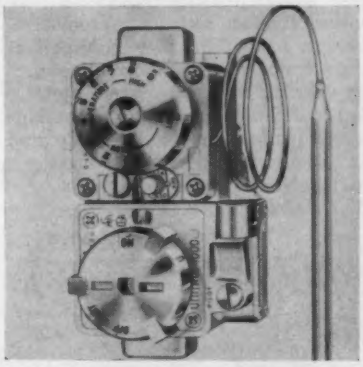


11. Exchanger line

Forty-six sizes; 1-, 2-, or 4-pass designs; and 1.2 to 124 sq ft of heat transfer surface are available in the Ross line of Type BCF exchangers. The pre-engineered line is designed for cooling lube oil, jacket water, hydraulic and other fluids.
Ross Heat Exchanger Division

12. Lighting sets

Low-voltage lighting sets from Joy Manufacturing are reported to be absolutely safe to use around metal structures, even in dripping wet conditions. They provide 200 to 400 watts of grounded illumination in a choice of 6, 12, or 32 volts, from conventional 110/120 vac power sources.
Joy Manufacturing Co.



13. Heating control

Unitrol 1000 is a combination control for space heating. Robertshaw has designed the control for complete flexibility — making it easy to convert manual units either in the field or factory to automatic controls without use of special tools.
Robertshaw-Fulton Controls

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14. Wall heater

With Heil-Quaker's new direct-vent gas wall heater, safe, low-cost zone heating is provided for many commercial and domestic applications. This "heater that breathes outside air" uses only outside air for combustion and exhausts the products of combustion through a sealed porcelain combustion chamber to the outside.
Heil-Quaker Corp.

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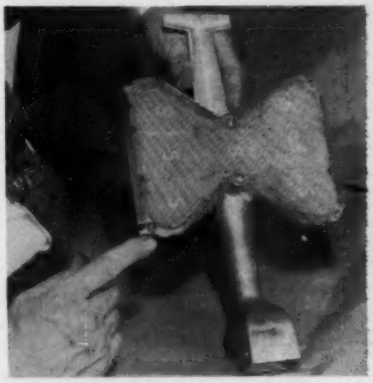
15. Versatile valve

Gas and many other products can be handled by Kerotest's new Keroseal valve, a non-lubricated, optional-flow, double-block, and bleed full unit. Features include elimination of galling or wear at seating surfaces, insurance against product contamination through a vapor-tight seal.
Kerotest Manufacturing Co.



16. Radiant-heat broiler

A radiant heat broiler that eliminates pre-heating and cuts cooking time in half has been introduced by Hardwick Stove. Upon ignition, the Infra-Ray broiler generates a temperature of 1600°F. Heat reaches food immediately because the wave lengths travel in a straight line.
Hardwick Stove Co.

---

17. Rotary drill

Both rock and sedimentary formations can be either air- or mud-drilled with Davey's new truck-mounted rotary drill. Model M-7WA—suitable for gas, oil and water well drilling — works to depths exceeding 3500 ft with 2⅞-in. pipe and over 2500 ft with 3½-in. pipe.
Davey Compressor Co.

---

18. Pressure gauge

A 3-in. strip chart is used on Bristol's new recording pressure gauge. Sizes range from 0-3 psi up to 0-60 psi. Versions available include one that will record and indicate on pressure measurement, one that records and indicates one pressure while recording a second and one that records and indicates one pressure and indicates the second.
Bristol Co.

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19. Gas range

New top-of-the-range 4-way cooking center, "Insta-Set" back panel, and king-size 20-in. oven are some of the features offered in the 1958

GAS DIGEST

Roper line of gas ranges. Featured is the Rotis-O-Grill, which serves as a range-top rotisserie, a vertical broiler, and a built-in griddle. Covered, it provides a handy extra work space. Also featured is a spit with built-in meat thermometer.
Geo. D. Roper Corp.

20. Transistor mobile radio

General Electric is producing a transistor-powered line of mobile radio equipment. A 60-watt mobile unit is a feature of the new line. Other wattages also are available. The transistorized power supplies in the units are associated with both the transmitter and receiver.
General Electric Co.

21. Low-boy furnaces

Three gas-fired furnaces with input rates of 105,000, 135,000 and 165,000 Btu/hr make up the new low-boy line of the Coleman Co. All models are built along low compact lines to facilitate installation in basements with low ceilings and other areas with less than average clearance.
Coleman Co. Inc.

22. Gas analyzer

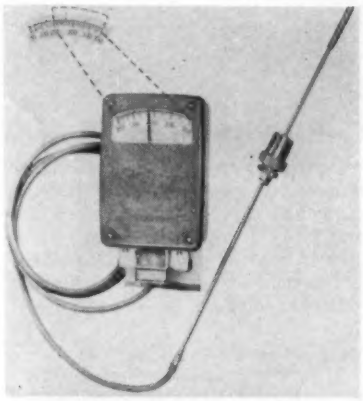
Long-life filament and remote analyzing head with explosion-proof housing are used in MSA's new combustible gas analyzer. Model F is designed to provide flexible, centralized instrumentation for process control and industrial safety. It does this by continuous or intermittent sampling and measurement of combustible gases and vapors in mixtures with air at normal or high temperatures.
Mine Safety Appliances Co.

23. Instrument cabinets

New counter-height equipment cabinets are designed for research, production control, and instrumentation activities where operators either are on the move or are standing. Elgin Metalformers engineered the units to improve operator efficiency and reduce fatigue where operator must move from point to point to take readings and operate controls while observing the action under control.
Elgin Metalformers Corp.

24. Service bodies

As part of its program for stronger and more modern service bodies, J. H. Holan has added three new design features. The one-piece rigid fender has an automotive-design look. The new rub rail is curved to give it more resistance to dinging and to improve appearance. The superflush handle eliminates projections on the body and is indented to give more strength and better appearance.
J. H. Holan Corp.



25. Indicating transmitter

Temperature measurement in ranges from 100°F to 600°F are transmitted pneumatically with Foxboro's compact indicating temperature transmitter. The unit features spans of 100 and 200°F. Use of expanded scale increases output pressure change per degree temperature change.
Foxboro Co.

26. Duct furnace

Simpler installation in less space is featured in a new line of AGA-approved gas-fired duct furnaces from Carrier. Compactness makes the units adaptable for heating in conjunction with air conditioning installations in low-ceiling structures. They can be used in existing duct work to add heat to air conditioning system or an undersized forced air heating plant.
Carrier Corp.

27. Valve

Watts Regulator has added to its line of fuse-plug type temperature and pressure relief valves. The new series, No. 131, features all-bronze construction with flexible, high temperature resisting, corrosion-proof diaphragm. The ¾-in. valve has an AGA water temperature rating of 375,000 Btu/hr.
Watts Regulator Co.

TRADE LITERATURE

28. Weed control

Year-round programs of foliage, basal and stump spraying for maximum week and brush control along rights-of-way are presented in a Monsanto Chemical booklet.
Monsanto Chemical Co.

29. Clamshell buckets

A two-color specification bulletin describes a line of clamshell buckets. Included are complete specifications and job action photos of both the general purpose ⅜-yd and special ½-yd rehandling buckets.
Schield Bantam Co.

30. Control Manual

General Controls has published the seventh edition of its B-60 service manual for the installer and serviceman who works with heating and air conditioning equipment and controls.
General Controls Co.

31. Steelcase meters

Three bulletins from American Meter present technical information on the company's line of welded steelcase meters. Discussed are 75-to-300 cfh models, the W-75 with a rated gas capacity of 75 cfh, and the W-45 LPG, which delivers 45 cfh propane.
American Meter Co.

32. Vertical boom ditcher

Barber-Greene's new vertical boom addition to its ditcher line is discussed and illustrated in a 16-page, 2-color booklet.
Barber-Greene Co.

33. Pipeline filters

Descriptive information and photos on Staynew pipeline filters for air and other gases are contained in a 4-page, two-color bulletin from Dollinger.
Dollinger Corp.

34. Gas-fired furnaces

Complete specifications, including input and output ratings, on

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GAS DIGEST

Airtemp's 1958 line of furnaces, are presented in a new folder. Discussed is the company's latest engineering development, a downsweep contour flame burner.
Chrysler Airtemp Division

35. Diaphragm seals

Diaphragm seals designed to protect pressure instruments against corrosion and clogging are described in Brooks Bulletin 250.
Brooks Rotameter Co.

36. Diesel-powered tractor

Major advances in design of the Allis-Chalmers HD-21 turbocharged diesel-powered tractor are described in a 2-color, 16-page catalog.
Allis-Chalmers Mfg. Co.

37. Pressure reducing valves

Dead end shut off on all fluid services is the function of Jordan's sliding gate pressure reducing valves, described in a 6-page bulletin. Flow capacity charts, dimensional drawings, and specifications are included.
Jordan Industrial Sales

38. Lab furnaces

A 4-page bulletin from Selas describes compact, lightweight lab furnaces. These furnaces provide continuous or intermittent operating temperatures from 1000°F to over 3350°F for testing or processing small samples.
Selas Corp.

39. Engine analyzer

Kistler's engine analyzer for measuring ignition, vibration and all pressures is the subject of a new 4-page illustrated bulletin.
Kistler Instrument Corp.

40. Heavy-duty excavator

A crawler-mounted excavator, said to fill a production gap on construction and material handling jobs, is the subject of a 4-page bulletin.
Koehring Division

News about plastics and corrosion prevention

41. Plastic fittings

New line of light-weight, injection-molded PVC pipe fittings will boost use of PVC piping systems under moderate pressures and temperature conditions. Tube Turns predicts wide application in such fields as gas transmission lines. The new fittings match the burst strength of Schedule 40 PVC pipe.
Tube Turns Plastics Inc.

42. Plastic pipe joiner

Industrial Polychemical's Weld-On is a fusion welding compound for joining plastic pipe: PVC, Kralastic, Butyrate, Cycolac. Compounds are used to effectively weld all slip (non-threaded) joints. Bonding material in each case is at least equal to physical and chemical properties of the pipe and fittings.
Industrial Polychemical Service

43. Corrosion meter

The Corrosometer measures electrically the progress of corrosion on a metal specimen installed in any corrosive system. Readings are obtained directly in microinches of metal loss. Model CK, a portable unit, can be operated by line or by self-contained batteries.
Crest Instrument Co.

44. Plastic insulator

A rugged plastic insulator, said to be impervious to moisture, corrosion and decay, has been developed by F. H. Maloney. According to reports, it represents a completely new concept in plastic pipeline insulators. Model 57 insulator is designed to absorb load shocks and provide cathodic protection at pipeline crossings. It is available in size ranges from 2 through 36 in. Composed of glass fiber reinforced polyester, the insulator is compression molded at controlled high temperature and pressure.
F. H. Maloney Co.

45. Protective coatings

Laminated pipeline protective coatings from Plicoflex are discussed in literature from the company.
Plicoflex Inc.

46. Plastic Pipe

Marken's ⅜- to 4-in. rigid and flexible piping and tubing is described in literature. Also discussed is the company's line of plastic fittings.
Marken Plastics Corp.

47. Plastic valve

Sloane's globe-type tenite-butyrate globe valve is described in brochures from the company. The valve is available with either plain ends for "solvent-welding" butyrate pipe, or with threaded ends for connecting to threaded metal and plastic pipe.
Sloane Manufacturing Co.

48. Pipe and fittings

A catalog from Lascopipe lists the various types of plastic pipe and fittings available. Complete specifications together with physical properties of Lascopipe's PVC products are presented.
Lascopipe

49. Moisture monitor

Checking water content in gas transmission lines is one of the jobs of Consolidated Electrodynamics' portable unit described in literature published by the company.
Consolidated Electrodynamics

50. Service pipe

Detailed information and specifications on Kraloy's ½-in. plastic service pipe are presented in literature available from the company.
Kraloy Plastic Pipe Co.

51. Sealants

Adhesives and sealants produced by Furane Plastics are the subject of descriptive literature.
Furane Plastics Inc.

52. Pipe wrap

Findings of recent performance tests conducted by the U. S. Bureau of Reclamation on L.O.F. Glass Fibers' glass reinforcement for pipe enamel coatings are presented in a 6-page product folder.
L.O.F. Glass Fibers Co.

53. Zipped wrapping

Zippertubing Co. has developed a tape which is wrapped around the pipe, then zipped shut by means of a plastic track. When zipped around the pipe, the uncured butyl will flow into valleys, pits or scratches in the pipe. Descriptive brochures are available from the company.
Zippertubing Co.

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GAS • PEOPLE

W. R. Stephens
Ark La

D. W. Weir
Ark La

Lindsey Hatchett
Ark La

Owen M. Jones
Cascade

W. R. STEPHENS has been elected president of Arkansas Louisiana Gas Co., Shreveport. He succeeds the late J. C. Hamilton. Mr. Stephens has been chairman of the board since January 1957 and will continue in that position. D. W. WEIR was elevated to the newly created post of executive vice president and elected to the board. LINDSEY HATCHETT also was elected a new vice president of the company. Mr. Weir previously served as vice president and Mr. Hatchett has worked on special assignments for ALG for several years.

OWEN MARSHALL JONES has succeeded C. SPENCER CLARK as president of Cascade Natural Gas Corp., Seattle. For the past year Mr. Jones has served Cascade as vice president, finance, and treasurer. Mr. Clark is resuming his former

Fence Rider

The Fence Rider looks for breaks in the rancher's fences. SCF consultants "Ride Fence" by locating gas leaks using Vegetation Method, Safety or Combination surveys.

Southern Cross Foresters locate leaks for gas companies, nationwide, accounting for "unaccounted-for" and eliminating safety hazards.

SOUTHERN CROSS FORESTERS

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duties as chairman of the board of directors.

A. M. SCHULTZ has joined Quebec Natural Gas Corp., Montreal, as manager of sales and service. Mr. Schultz formerly was domestic sales manager of Minneapolis (Minn.) Gas Co.

WILLIAM H. COCHRANE has succeeded DANTE E. BROGGI as president of Neptune Meter Co. Before assuming the presidency, Mr. Cochrane was executive vice president of Neptune, responsible for coordinating policies and operations affecting administration, manufacturing and sales activities among Neptune and its subsidiaries.

Several appointments have been announced by ElectroData division, Pasadena, Calif. LEE MOULTON is manager of field engineering training, replacing LELAND W. BROWN, who is now Los Angeles district field engineering manager. ALBERT W. SWAN is central regional field engineering manager. W. B. WIGHT is manager of the newly organized materiel department.

JAMES L. WALKER is now operating manager of Arkansas Western Gas Co., Fayetteville, Ark. Mr. Walker, who has been assistant operation manager since 1948, will be in charge of the company's operations and its safety program.

Ebasco Services Inc., New York, has appointed ROBERT E. PIERCE as chief consulting engineer and SAMUEL B. SMITH as consulting electrical engineer. Mr. Pierce succeeds HOWARD L. MELVIN, who continues with the company as a general engineering consultant.

JOHN A. MILLS has been promoted to district manager of United Gas Corp.'s Mississippi

A. M. Schultz
Quebec Natural

W. H. Cochrane
Neptune

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to solve your unaccounted-for-gas problem.

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☐ "W" — *Type Survey* — provides a complete leakage control program for the downtown and commerical areas including street and building inspections.

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- Before-and-after surveys for new construction or conversions
- LP Surveys
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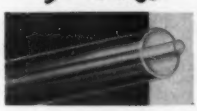
It is transparent . . . made from one specific material formulation containing the same physical properties shipment upon shipment. Its high quality is constant. Made to same O.D. as steel pipe with 2 wall thicknesses. Close tolerances insure leakproof, trouble-proof ease of installation. Complete line of fittings.

IT'S CLEAR! YOU CAN SEE IT'S BY Busada



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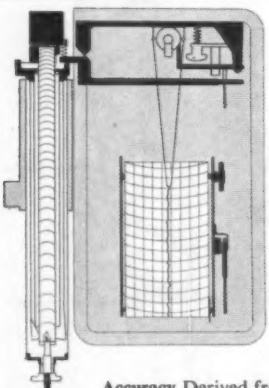
Representatives in: Boston, Los Angeles, Shreveport, La., Kingsport, Tenn., Grand Rapids, Mich.



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LOW IN COST

Calorific values of all combustible gases from 80 B.T.U.'s and up are read and recorded by the Sigma Mark II Recording Calorimeter. Its economy and performance are unmatched by any other similar instrument.

Accuracy Derived from a unique but simple design. Provides immediate and automatic compensation for wide variations in specific gravity, temperature and atmospheric pressure.

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Highly Adaptable Records calorific value of natural gas, coke-oven gas, producer gas, blast furnace gas, water gas, L-P gas, coal gas, and many others. Suited for wall or panel mounting. Takes little space. With special equipment can also record between 0-80 B.T.U.'s.

Write For More Information

COSA *National Representatives for Sigma Instrument Co., England*

Cosa Corporation, 405 Lexington Avenue, New York 17, N. Y.

people • *Continued*

Coast district with headquarters at Gulfport. Most recently Mr. Mills served as chief accountant for the Mississippi division.

ERNST A. SIEMSSEN has been appointed to the newly created post of tool and liaison engineer and coordinator of Selas Corp. of America, Dresher, Pa.

EARL HEFNER has been named assistant sales manager of Holly-General, Pasadena, Calif.

LYLE MCDONALD has retired as chairman of the board of directors of Public Service Electric & Gas Co., Newark, N. J. He will continue as a director. DONALD C. LUCE, president, becomes chief executive

Donald Luce
Public Service

Lyle McDonald
Public Service

officer of the company. Mr. McDonald started with Public Service in 1916 as an accountant, has been a director since 1944 and chairman since 1954. The board of directors also elected FRANCIS A. KEANE vice president in charge of finance.

F. IRVING YEWMAN has been named general sales manager of Lakeland Natural Gas Ltd., Kingston, Ontario. He will be in charge of all business development activities of the company. Most recently Mr. Yewman was appliance sales manager with Addison-Norge Ltd.

PIERCE W. BUTLER JR. has been named manager of the new American Meter Co. plant in Wyalusing, Pa. He formerly was personnel manager of the Erie, Pa. plant.

J. H. CURTIS, W. H. COLQUHOUN, and E. K. WILKINS have been elected directors of Ebasco Services Inc., New York. Mr. Curtis is

president of Chemical Construction Corp., while Mr. Colquhoun and Mr. Wilkins are vice presidents of Ebasco.

GEORGE E. OLMSTED is the newly elected treasurer of Consumer Power Co., Jackson, Mich.

A. W. BECK has been named to the new post of vice president of marketing for Robertshaw-Fulton Controls Co. He also becomes a member of the company's executive staff with headquarters in Richmond, Va. Formerly, Mr. Beck was sales manager of the Grayson Controls division.

Two assistant vice presidents of sales have been appointed by Milwaukee (Wis.) Gas Light Co. PHILIP E. ARNOLD, who has been

A. W. Beck
Robertshaw

P. W. Butler, Jr.
American Meter

with Milwaukee Gas since 1956, is in charge of promotion, sales training and advertising. PHILIP E. CASPER will direct all retail, dealer, builder contractor, and apartment sales. Both men will report directly to Bruce A. McCandless, vice president of sales.

THEODORE W. LAUB has been promoted to budget manager of the Peoples Natural Gas Co., Pittsburgh.

RUSSELL SHAFFER has been promoted to director of purchases for White-Rodgers Co., St. Louis. Prior to his promotion, Mr. Shaffer served as a purchasing agent and as head of the purchasing department.

ROBERT E. SEYMOUR has been promoted to assistant to the president of the Peoples Natural Gas Co., Pittsburgh. In his new position, Mr. Seymour will coordinate activ-

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Insulating Couplings AND Fittings

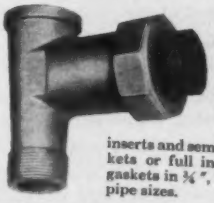
Malleable Couplings

Normac Insulating Malleable Couplings and fittings are available with polyethylene inserts and semi-insulating gaskets or full insulating rubber gaskets.

Malleable Service Ell

The insulating principle depicted above is carried out in all Normac Ells and Tees.

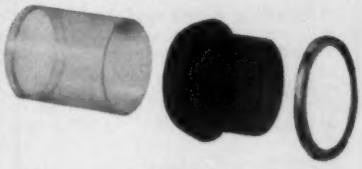
Brass Fittings



Normac insulating Brass compression end Tees, Ells and all compression end fittings are available with polyethylene inserts and semi-insulating gaskets or full insulating rubber gaskets in ¾", 1" and 1¼" iron pipe sizes.

NORTON McMURRAY has specialized for 20 years in the development and production of products solely for the Gas Industry. Whether your plans include modernization, or new, expanded facilities, Normac Gas Distribution Equipment will serve you well.

Insulating Gaskets



The Normac insulating principle incorporates an efficient combination of a polyethylene sleeve and a semi-insulating gasket or full rubber gasket and retainer ring.

New CATALOG
Write for your copy . . . it gives complete details and specifications of NORMAC equipment.

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- Seal Tight Pipe Shield
- Steel Strapping and Seals
- Poly-Mastic Coatings
- Royston Endseals
- Nelson Flange Insulations
- Plico Insulating Spacers
- Plico Casing Seals
- Cadweld Connections
- Federated Anodes
- Pipeline Pigs
- Nylon Bushings—Couplings
- Fleetline Vents and Markers
- Saddles and Reducers
- Plidco Flanges
- Weld + Ends
- Smith + Clamps
- Holiday Detectors
- H & M Bevelling Machines
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- Welding Clamps
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people • *Continued*

Robert Seymour
Peoples Natural

Marion Thrash
Peoples Natural

ities of all departments in the preparation of planning and forecasting data. Peoples Natural also announces the appointment of MARION M. THRASH to assistant public relations director. Mr. Thrash, with the company almost nine years, will be in charge of press relations and publications. He is the editor of the company's magazine, *The Peoples' Voice.*

J. M. FOUTS has joined Falcon Line Products Corp., Pittsburgh, as northeastern division manager. Mr. Fouts, a 25-year veteran in corrosion engineering, formerly was with the sales department of Koppers Tar Products division. He will operate from Falcon's branch office in Elizabeth, N. J.

WILLIAM G. WEPFER has been appointed national sales director for Arkla Air Conditioning Corp. He is establishing a national sales office for the corporation in Little Rock, Ark.

Rockwell Manufacturing Co., Pittsburgh, has created two separate export sales departments. NELSON E. DAVENPORT, assistant to the vice president of sales in the meter and valve division, has been named export sales manager—meter and valve products. WALTER G.

J. M. Fouts
Falcon

William Wepfer
Ark La

WHAT'S INSIDE MAKES A BIG DIFFERENCE

You know that the life of your meter diaphragms has a direct influence on your operational efficiency.

You also know that the diaphragms which are the heart of your meters must withstand extreme conditions without speed up or slow down.

Vulcan provides integrated research development and manufacturing facilities. This means complete quality control from raw material to finished product; assuring you that every diaphragm is made to strict specifications.

Specify Vulcan — and be sure!

Another REEVES VULCAN RUBBER PRODUCT

REEVES BROTHERS INC.
Vulcan Rubber Products Division
54 Worth Street • New York 13, N.Y.

GEORGE, who has been assistant export manager—Delta power tools, has been named export sales manager—power tools and municipal products.

S. REESOR KAUFMAN has been elected vice president and general manager of Great Northern Gas Utilities Ltd., Edmonton, Alberta, following the resignation of F. J. SIMINGTON. DAVID B. MANSUR succeeds Mr. Simington to the board and CARMAN G. KING succeeds WALTER F. THORN, who has resigned.

ORVAL W. ADAMS, Salt Lake City banker, has been elected to the board of directors of Mountain Fuel Supply Co. He succeeds the late HERBERT A. SNOW.

FRANK J. LYDICK has joined Peoples Natural Gas Co., Pittsburgh, as public relations director. Mr. Lydick previously was with the information services section of Westinghouse Electric Corp. Peoples also has announced the promotion of GUY E. MCALISTER to office manager.

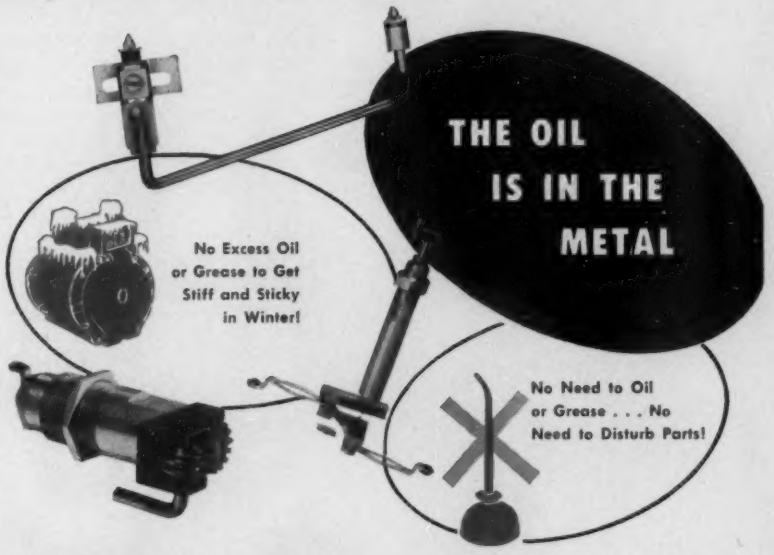
HENRY A. CORREA has been elected vice president for foreign operations of ACF Industries Inc., New York.

Several appointments have been announced by Union Carbide Chemicals Corp., New York. C. A. PENTZ is group leader in the development department in South Charleston, West. Va. New members of the department are GEORGE B. KELLY JR. and FRANK D. HEINDEL. Transfers include CLAIR S. MITCH to Chicago, ROBERT G. SHORT to Charlotte, CARL N. SPAGNUOLO to Philadelphia, and GEORGE A. LESCISIN to Washington, D. C.

J. HENRY LONG has been named manager of Philadelphia (Pa.) Electric Co.'s gas department. He succeeds E. G. BOYER, who has retired. Mr. Long has been with Philadelphia Electric since 1927.

RICHARD BISHOP has been promoted to general supervisor of gas distribution for Consumers Power Co., Jackson, Mich. Mr. Bishop joined Consumers in the general gas department in 1948 as a junior engineer. In 1950 he was named general gas distribution assistant

Lancaster PARTS STAY ACCURATE BECAUSE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No Excess Oil or Grease to Get Stiff and Sticky in Winter!
No Need to Oil or Grease . . . No Need to Disturb Parts!

All moving parts of Lancaster Main Movement, Index Drive and Carrier Wire Assemblies operate in oil-bearing metals. Once installed and adjusted they need not be disturbed for oiling and greasing.

Lancaster parts are easy to install and adjust . . . and they maintain their unexcelled accuracy because Lancaster parts have more oil bearing metal surfaces than competitive assemblies.

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For Proper Meter Care Use These Lancaster Quality Products

Cork Gaskets	Index Stuffing Boxes Grease and Packing
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Glass Grinding Blocks	Neoprene Connection Washers
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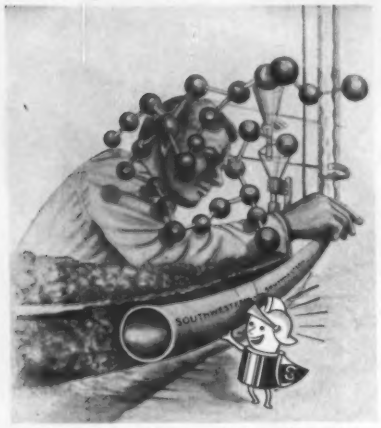
Southwestern
PLASTIC PIPE

from laboratories to ENGINEERED APPLICATION on your job . . .



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A fully-equipped laboratory; rigid quality control; constant experimentation in new types & broader uses of plastic pipe.

Fifty Years' Experience

A half century in the manufacture of pipe. Organized by the founders of *Texas Vitrified Pipe Co.* and the *Cannelton (Indiana) Sewer Pipe Co., Southwestern* is a pioneer in the plastic pipe field.

Complete Product Line

All standard sizes in our five lines: SOUTHWESTERN Kralastic, PVC, Polyethylene, Butyrate, Chem-Weld Drainage Pipe, and *tailored dimensions* in all lines to meet specific needs.

Field Supply Stocks

For prompt and complete service to you. These stocks are strategically located in the West, Southwest and South.

Engineers on Call

A trained staff of APPLICATION ENGINEERS is on call to consult with you in your pipe needs.

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SWP-1

people • *Continued*

and in 1953 became gas operations engineer.

Directors of Long Island Lighting Co., Mineola, N. Y., elected WILMOT O. SMITH vice president in charge of gas and electric sales. At the same time CHARLES E. ELBERT, secretary, took on new duties as assistant to the president.

MILTON H. NELSON has been promoted from controller to treasurer of Dresser Manufacturing Division, Dresser Industries Inc., Bradford, Pa. Newly appointed controller is GORDON E. MOTT, who has been assistant to the general manager, finance.

Gordon Mott
Dresser

Milton Nelson
Dresser

W. J. C. Marshall Jr.
Dresser

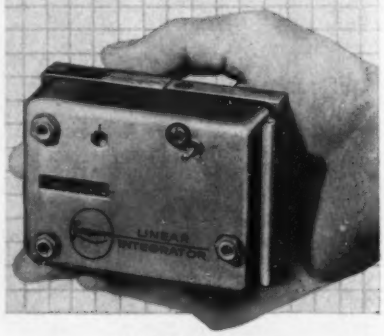
C. E. Boston
Dresser

Two new general markets sales representatives have been appointed by Dresser Manufacturing division, Bradford, Pa., one of the Dresser Industries Inc. WILLIAM J. C. MARSHALL JR. will work in the New England area and C. E. BOSTON is the representative for northern California and western Nevada.

ROBERT L. WROE has been appointed an instructor in the training center of the Foxboro (Mass.) Co. Mr. Wroe formerly was in charge of accessories promotion with the Foxboro service and repair division.

automatic flow computation

BY LIBRASCOPE



MODEL 25

Computing Linear Integrator

. . . is designed for temperature recording, averaging and area computation in gas analysis procedures. Providing a fast, accurate and a continuously integrated total of data as it is being recorded, the Librascope Model 25 can be installed on any device having shaft rotation or displacement as an output.

Write for New Bulletin

Representatives in principal cities

LIBRASCOPE — PRECISION GENERAL CPL COMPUTATION

LIBRASCOPE, INCORPORATED
40 East Verdugo St., Burbank, Calif.

MAURICE L. CARSON has been promoted to utilization manager for Southern Union Gas Co., Dallas. In his new post, Mr. Carlson will head the company's recently formed utilization department. He joined Southern Union as gas sales engineer in 1956.

Deaths

LELAND K. SPINK, 58, engineer in charge of flow measurement at Foxboro Co., died recently in Foxboro, Mass. Mr. Spink pioneered in calculating and coordinating flow data. Among his inventions are the square root planimeter and slide rules for sizing control valves and orifices. He participated in the early work of the AGA on orifice coefficients, effect of distributing fittings, and use of straightening vanes. He was a member of the committee which prepared AGA Report No. 3 generally used as a code for natural gas flow measurement.

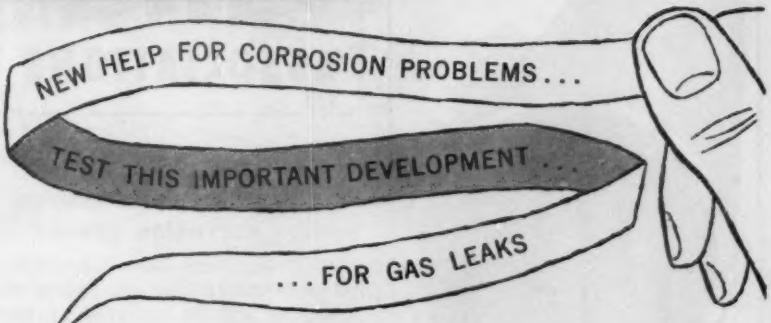
JACK W. BROWN, Keyport district manager for the New Jersey Natural Gas Co., died recently. He was 52. Mr. Brown joined New Jersey Natural in 1952 after 22 years with Public Service Electric & Gas Co.

THOMAS E. HUESTON, assistant to the industrial relations manager of the gas department at Public Service Electric & Gas Co., died recently. Mr. Hueston, 52, had been with the Newark, N. J. company for 31 years.

A. WARREN EGGER, 57, comptroller and assistant secretary of Central Illinois Light Co., died recently at his home in Pekin, Ill. He was associated with the company throughout his entire business life, joining Central Illinois as a clerk in 1919.

ALLEN L. CHICKERING, vice president of San Diego (Calif.) Gas & Electric Co., died recently in Oakland, Calif. Mr. Chickering served San Diego Gas in that capacity for 36 years and was a member of the board for 34 years. He resigned from the board in 1956. Mr. Chickering was a member of the San Francisco law firm of Chickering & Gregory, general counsel to San Diego Gas. He also was a director and executive committee member of Pacific Gas & Electric.

INVESTIGATE THIS TIMELY MESSAGE!



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The strongest sealing agent yet for patching gas pipe leaks, PERF-A-SEAL Epoxy is a truly important new development in the fight against corrosion. In actual test and use, this Epoxy Compound assures you . . .

• **Highest Tensile** • **Maximum Corrosion Resistance**
• **Highest Impact** • **Highest Burst Strength**

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- Electrical Inspection
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With Modern Portable Plant Equipment

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PIPE PROTECTION SERVICE, INC.
715 Elizabeth Ave.
Elizabeth, New Jersey

GAS ASSOCIATIONS

Appalachian short course covers corrosion causes

Both technical and non-technical presentations on the causes of corrosion will be featured at the 1958 Appalachian Underground Corrosion short course. The dates are June 10-12 at West Virginia University, Morgantown.

Among the features of this year's session will be the displays of 35 manufacturers. C. A. Erickson Jr., Peoples Natural Gas Co., Pittsburgh, is general chairman of the school. J. H. Royston, of Royston Laboratories Inc., Blawnox, Pa., is chairman of the publicity committee.

Walker and Cushman take new AGA posts

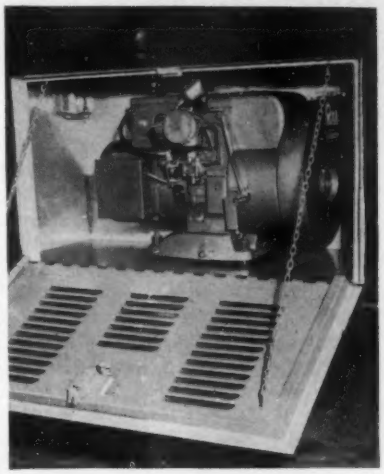
Harold S. Walker Jr. has been named assistant to the managing director of the American Gas Association. He joined the AGA staff in 1955 as secretary of the general management section. For the past year he served as secretary of the association.

Jac Cushman

Harold Walker

Jac A. Cushman, formerly assistant director of public information, is now corporate secretary and convention manager. Mr. Cushman joined the AGA in 1947 and served as editor of the *AGA Monthly* until April 1954. At that time he was transferred to the newly organized Public Information Bureau.

ELECTRIC PLANT NEWS



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Before the dual-purpose Onan Electric Plant was installed on this maintenance truck, it was necessary to run the 160 H.P. truck engine to charge batteries used for communication. Now, the 2 H.P. Onan Electric Plant does the same job...saving fuel and engine maintenance.

The electric plant is an Onan Model 07AK-1R/972. It has an output of 750 watts A.C. or it can deliver 8 amperes for 12-volt battery charging. Plug-in receptacles are provided for operating electric drills, saws and other equipment used in construction and maintenance work.

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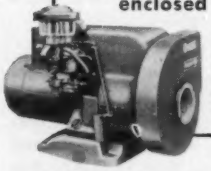
Vacu-Flo cooling permits enclosed installations



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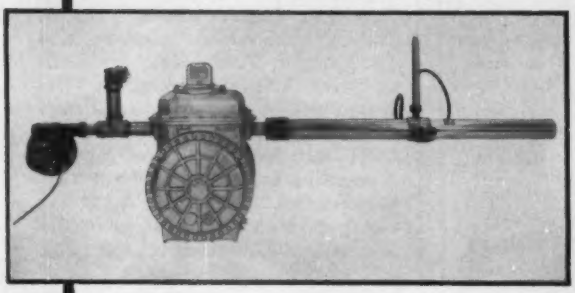

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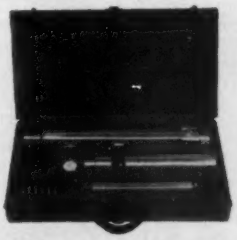

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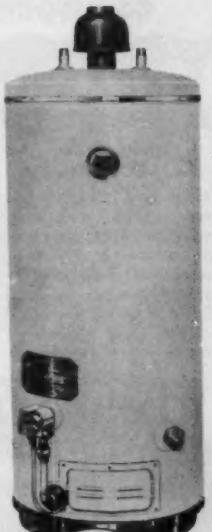

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New England gasmen heading for Boston

The 32nd annual gathering of New England gasmen convenes this month at the Statler-Hilton hotel in Boston. The two-day convention of the NEGA, March 20-21, is jam-packed with what promises to be stimulating panel discussions.

The opening session on the morning of March 20 will feature elections of officers and directors, Managing Director Clark Belden's report on the association's year, President Edgar Rhodes' report, NEGA achievement awards, and Dr. Charles F. Phillips, president of Bates College, speaking on "The Next United States—a Challenge to You."

At the first afternoon session, accounting trends will be the featured panel. Lester E. Reynolds, vice president and treasurer of the Connecticut Light & Power Co., will chairman the session. Main topics coming in for discussion are accepted accounting treatments which minimize income account fluctuations, responsibility accounting and budgeting, personnel selection and relations, and bad debts and collections.

Starting off the second afternoon session, devoted to the economics of future gas operations, will be William B. Tippy, president of Commonwealth Services, who will speak on "Trends in Distribution Expenses." Following Mr. Tippy is the operating panel, presided over by Fred H. Faulstich, vice president of Springfield Gas Light Co. Covered will be improving distribution system capacity by (1) use of computers, (2) raising pressures, (3) paralleling lines, (4) district regulators, and (5) radial and peripheral feeds. Also covered will be production developments: peak shaving, standby, storage, interchange, gas-making materials. The third phase of the operating panel will cover utilization developments.

Friday morning will be devoted to the "National Gas Industry Panorama," a symposium entitled "Today — It's Now Spring, You Know." Participating in the symposium are: Clifford Coons, president of GAMA; E. H. Smoker, chairman of the AGA general research planning committee; Harold Massey, GAMA's managing director; Thomas H. Lane, senior vice

president of the AGA's advertising agency, Lennon & Newell Inc.; Sewart Abbott, utilization engineer at AGA; Charles D. Barndt, chairman of the AGA general promotional planning committee; Robert W. Otto, president of AGA; and Mrs. Lindwood Findley, the current Mrs. America.

The early-Friday afternoon panel is titled "How Carefully Do We Listen," presided over by Managing Director Clark Belden. Subjects under discussion include periodic revision of gas utility policies and practices, conducting public opinion surveys regarding a utility's operations, and appraising the opinions received in light of public interest; planning indicated changes and introducing the changes, and periodic appraisal of public opinion trends concerning a utility's operations.

The last session of the convention will be a residential sales panel, presided over by John J. Quinn, vice president of Boston Gas Co. Before the panel gets under way, Herman Koester, Jr., president of W. Wirt Young & Associates, will speak on commercial and industrial possibilities. This final panel will touch on sales manpower, selling the new-home market, dealer-distributor programs, inducements to increase gas sales, retention of loads, effective advertising and promotion, and home service.

Gilbert J. Williams of the Connecticut Light & Power Co., heads the program committee. His vice chairman is Herman Koester, Jr., of W. Wirt Young & Associates.

Varied program planned for management meeting

Well-known speakers from both outside and within the gas industry will present a varied program at the General Management Conference in Washington, March 31-April 2. Hotel Shoreham is the meeting place.

Dr. Eli Ginzberg of Columbia University's Conservation of Human Resources group, will view the changing gas industry and its manpower demands. IGT's director, Dr. Martin A. Elliott, will explore the gas industry's long range prospects, and Dr. J. Philip Wernette of the University of Michigan's School of Business Administration will present the economic outlook. William Parker of Ketchum, MacLeod & Grove will show how gas utilities are using marketing research as a management tool.

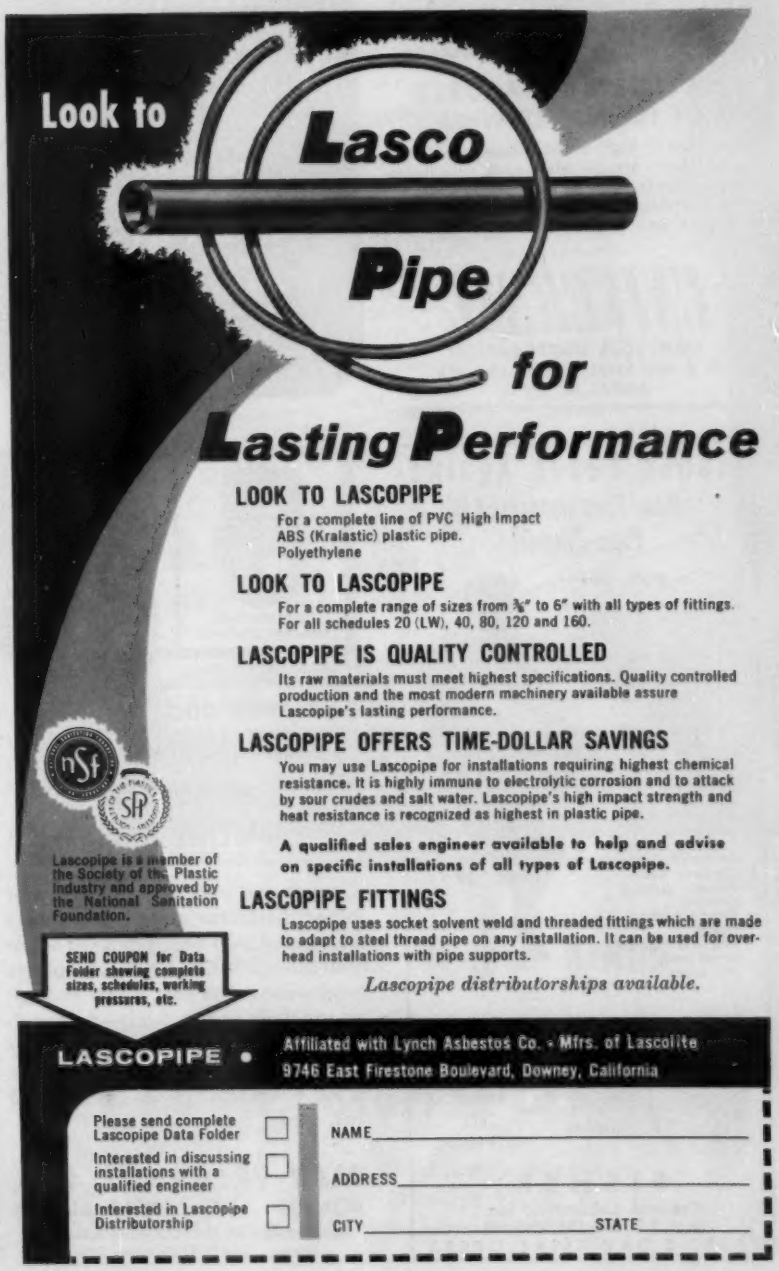
The financial picture and scientific inventory control will be covered by L. S. Reis, president of Reis & Chandler, Inc., and W. Everet Welch, director of purchasing, Aeronautical division, Minneapolis-Honeywell.

In addition to the general sessions, the afternoons will be devoted to open committee meetings. Planning meetings are accident prevention, financial management, insurance, personnel, and rate committees. The purchasing and stores committee will hold its own annual conference during the three afternoons.

Oklahoma announces gas conditioning conference

The gas conditioning conference of the University of Oklahoma is slated for March 5-6 at the university's Oklahoma Memorial Union Building on the Norman campus.

The first day's program consists of the following subjects: Gas hydrates, composition, formation, characteristics, and methods of handling, presented by W. M.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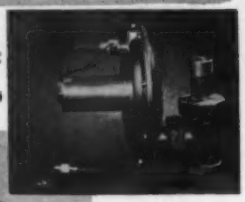

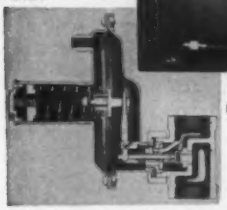

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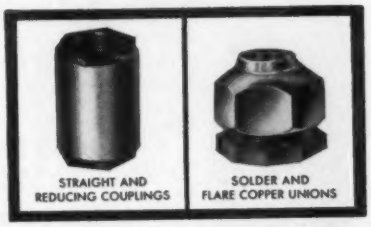

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The second day's technical session will cover problems associated with glycol injection, presented by L. D. Polderman of Carbide Chemicals Co.; recent developments in the application of molecular sieves, by E. L. Clark, Linde Co.; removal of acid gas constituents by the hot carbonate process, by A. G. Eichmeyer, consulting engineer, and a symposium on recent developments in gas conditioning. E. G. Hammerschmidt of Peoples Gas Light & Coke Co., will moderate the symposium.

Sponsors of the gas conditioning conference are the schools of petroleum and natural gas engineering, extension division, and business and industrial services of the University of Oklahoma.

1958 water heating campaign under way

The industry is in the midst of the 1958 commercial gas water heating sales campaign. The campaign, backed by the AGA, was launched in February and continues through April.

A new all-inclusive portfolio has gone out to gas company sales managers. It contains basic data and materials to organize a profitable sales campaign.

The activity guide book sets forth the necessary steps to be taken to put the campaign into operation. Direct mail selling is stressed and the portfolio contains many suggestions for sales letters together with manufacturers' literature and other sales helps.

The guide book also gives complete information on how to organize the sales force, how to secure cooperation of dealers, and how to conduct workshop meetings for regional restaurant and sanitation organizations.

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CORROSION PREVENTION

(CONTINUED FROM PAGE 19)

Based on examinations of literally thousands of crudes and the cataloging of these findings, we had now only to correlate these specific laboratory characteristics with known field protective values in order to determine whether a given crude residual asphalt was suitable as a pipe enamel.

Simultaneously with this particular research and development project, our technicians were engaged in formulating asphalts for other highly specific usages, above ground, below ground and below water, in environments where individual characteristics of resiliency, ductility, adhesion, cohesion and so forth were of varying importance —sometimes critically necessary, at other times unimportant—and in all such projects, in-the-ditch research took over where lab conclusions left off.

Based on these efforts and upon 30 years of intimate association with one basic material, we now say, with full documentation, that we predetermine with accuracy the actual performance of asphalt pipe enamel under a given set of circumstances.

In the paragraphs that follow we hope to detail some of the tests and reasoning behind our research. There is no way known to make certain portions of lab work interesting. Again, certain techniques are quite understandably "trade secrets."

First, note the photographs of laboratory slips. These show the findings on specific crudes (name deleted in photo, of course) reduced under vacuum to the viscosity and flash point desired, following which they were further processed. These tests are routine and are all conducted in identically the same manner. Note the data requested in the blanks. Interpretation of these characteristics to determine whether the residual asphalt will provide good service as a pipe enamel is both a science and an art.

Should a residual appear inherently to possess the required physical characteristics, it is then processed into a pipe enamel and subjected to a series of practical tests. ■

(To be continued in April)

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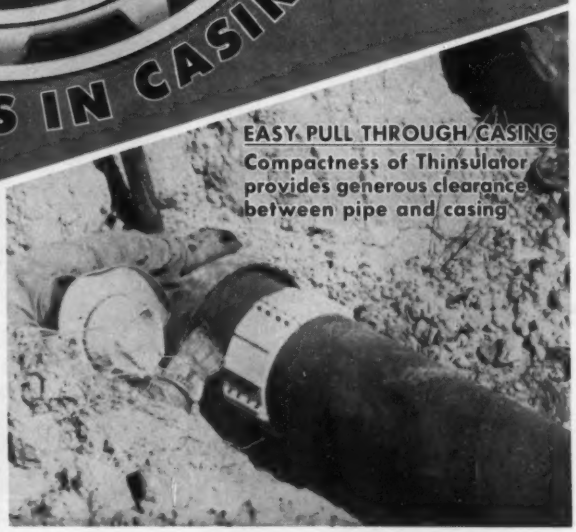

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PIPELINE SECTION

A case history of corrosion mitigation on an old uncoated 180 mile pipeline

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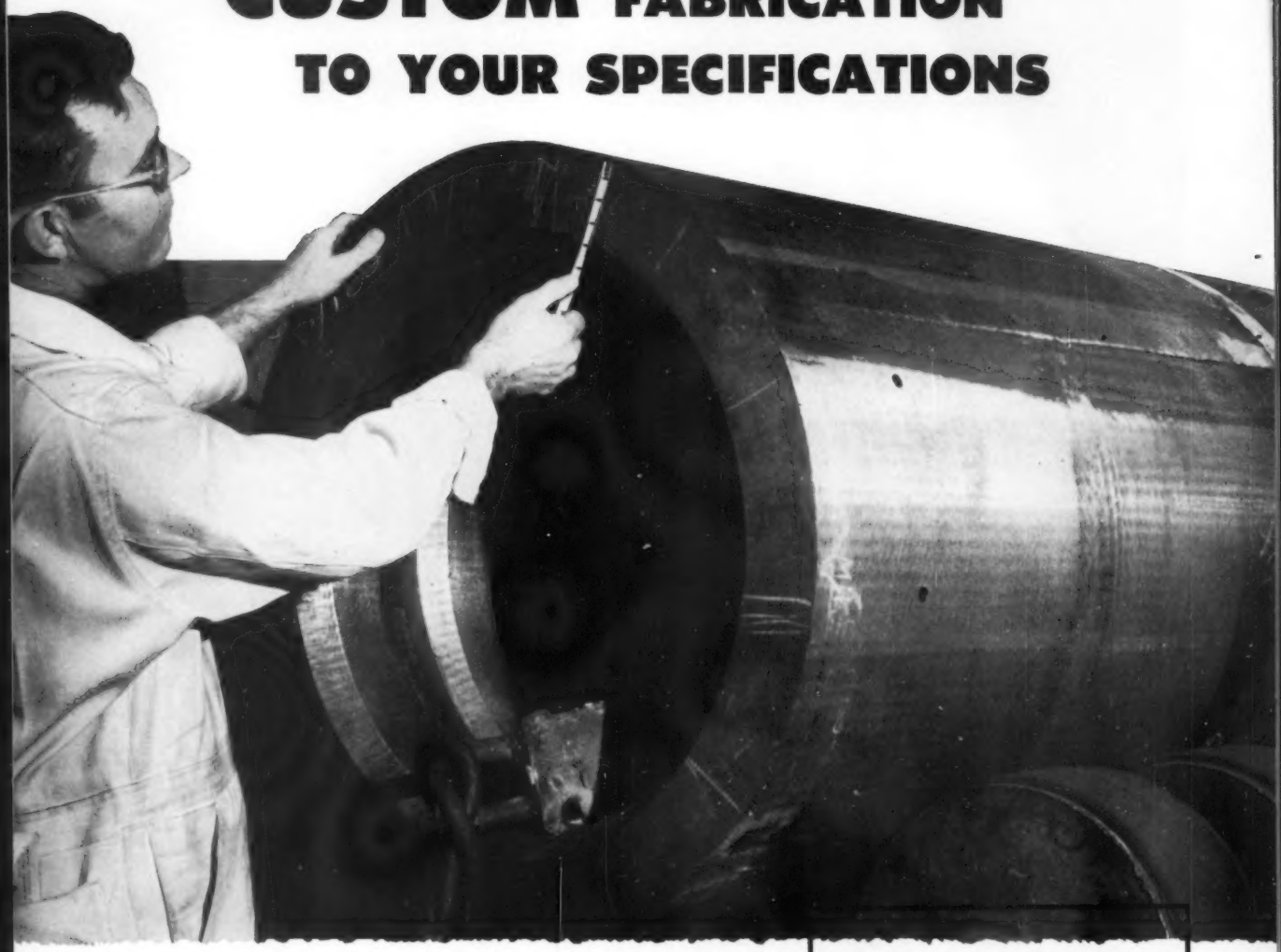

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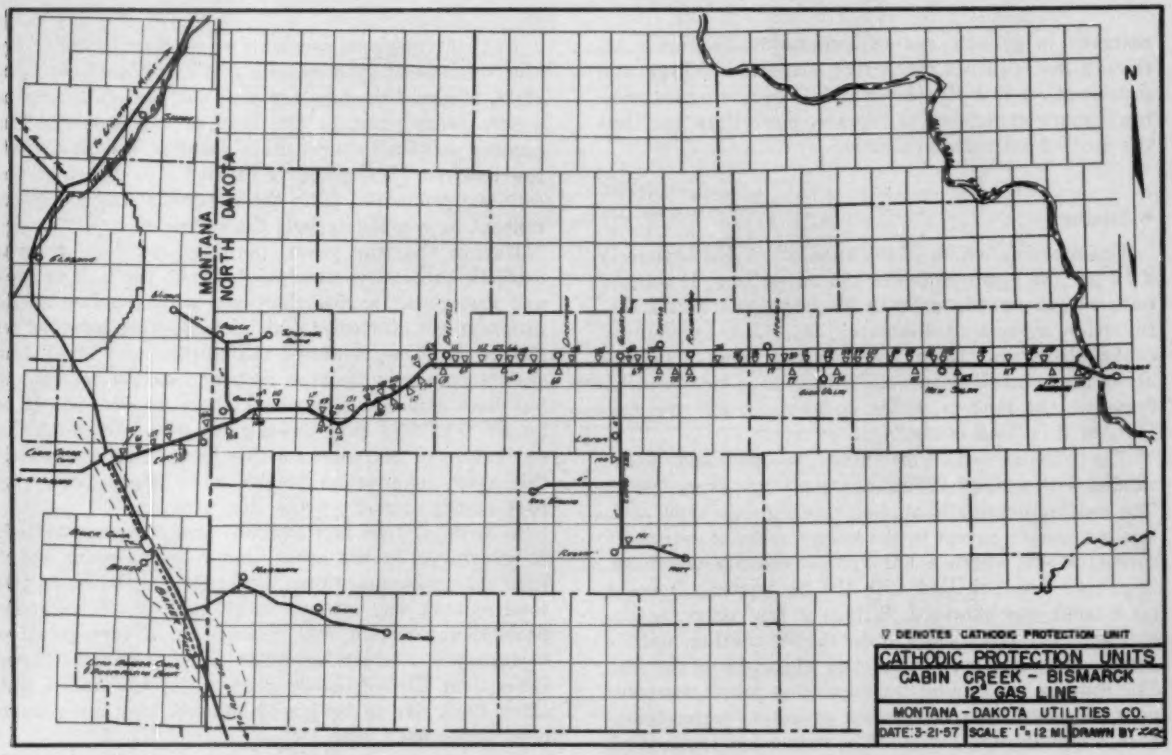

Cathodic protection of an old uncoated pipeline

By DAVID P. PRICE and RAY M. WAINWRIGHT*

GAS exclusive

THE supplying of "hot spot" corrosion protection to an old, uncoated pipeline vs. more complete protection of the line has been a subject of contention for many years. A number of extensive studies have been made to determine the economic feasibility of cathodic protection of entire uncoated lines of medium or large diameters; however, the successful applications under these circumstances have not received much publicity.

The following paragraphs describe one such successful application on a medium-sized gas pipeline. This application followed a situation of an extensive leak history soon after the line was constructed, and

* Mr. Price is corrosion engineer, Montana-Dakota Utilities Co., Glendive, Mont. Mr. Wainwright is director of engineering, Good-All Electric Mfg. Co., Ogallala, Neb.

Cathodic protection of an old uncoated pipeline

resulted in greatly reduced maintenance costs. Although the required protective currents are high, the preservation of a pipeline which is becoming increasingly more expensive to replace, *more* than justified the cost of cathodic protection.

• History

The pipeline which is the subject of this article is a 12-in. line approximately 180 miles long. It joins a natural gas field in eastern Montana to the city distribution system at Bismarck, N. D. A number of other cities and towns receive gas from this line along the route. The terrain traversed is mostly hilly. Some of the land is under cultivation, but the majoriy of it is "bad lands."

The pipeline was constructed in 1930 and is arc welded with wrinkle-type expansion joints every 300 ft. The coating originally applied was a grease type, cold-applied coating except in the known areas of extremely corrosive soil where a hot applied coating was used. A primer was not used with the hot coating, hence a poor bond was obtained. Within a few years, severe corrosion had taken place under the hot coating, and the cold coating had been completely absorbed by the soil. The coating job around the expansion joints was very poor, in most cases. Corrosion processes were, therefore, virtually uninhibited. The expansion joints were generally anodic to the pipe because of the difference in radius of the expansion joints, the difference in the size of the joints as compared to the pipeline, and the structural changes caused by the working of the metal in the expansion joints. It soon became apparent that the line would have to be recoated in the corrosive areas, presumably with a different type of coating.

As early as 1935, work was started on a ditch reconditioning program, covering less than 2 per cent of the line, in which the pipe was bared and thoroughly cleaned, a coal tar primer applied to the pipe, and a hot coal tar coating applied. A few years after this program was started, it became apparent that coating the line was definitely not a cure-all since leaks started re-occurring in the coated pipe. At that time, these leaks were attributed to a poor coating job rather than to the material. Consequently, in 1938, a corrosion engineer was hired and instructed to start a cathodic protection program. In 1939, seven wind-generator cathodic protection units were installed along the line in the extremely corrosive areas. After this initial experiment, the cathodic protection program was concentrated on other pipelines, which was unfortunate as far as this line was concerned. It is understandable why the program was not continued at the time because of lack of experience with such cathodic protection programs, and because of the necessity of concentrating available money and manpower on more intensely corroding lines.

In 1942, it became necessary to start replacing extensive sections of pipe because of its seriously corroded state. Much of the pipe replaced had been ditch-coated a few years prior to the time of replacement. The popular opinion in these cases was that the ditch coating had not been properly carried out, and that the cathodic protection from the windmills was too intermittent to completely halt the corrosion.

During the war years, nothing was done from a cathodic protection standpoint due to the lack of men and materials. In 1947, however, a magnesium anode program was started in which anodes were installed on all the short segments of coated pipe and in all low resistance areas. Because of poor location records, it has been impossible to check these anodes, but it is known that they have had a great deal to do with the mitigation of corrosion on this line. From 1947 until this year, magnesium anodes were added yearly as part of the cathodic protection program.

In 1949, a large pipe renewal program was started. It was large in the sense that a great many short segments of corroded pipe were replaced; however, the total footage was not very large. In 1950, the cathodic protection program was renewed in a very positive move when 20 rectifier units were installed. Three years then elapsed before more units were added, but after 1953, five to twelve 60-amp rectifier units have been added each year.

A resistance survey was made of the line in 1954 and hundreds of test holes were dug to determine the condition of the line. In 1955, over six miles of pipeline were replaced in short sections in an effort to make this line suitable for pressures up to 500 psig. The line had originally been designed for a maximum of 500 psig, but many sub-standard valves and fittings had been installed and were replaced that year. This move complicated the cathodic protection picture since it made it necessary to take the strength of the line into consideration in any cathodic protection versus pipe replacement plans. Because of the increased operating pressure, all seriously corroded pipe that is found is being replaced. At the present time, 15 per cent of the line has been replaced with mill-coated pipe and about 80 to 90 per cent of the entire line is receiving complete cathodic protection, including the renewed sections.

It is felt that most of the pipe remaining in the line is of sufficient strength to withstand the present operating pressures, and it is believed that very little more pipe will require replacement. A few more cathodic protection units will be necessary to achieve complete protection of the entire line, however.

• Soil conditions

Soil resistivities vary greatly along this pipeline as can be seen by *Fig. 1*, which is a resistance sheet for slightly over a mile of pipeline right-of-way. On this

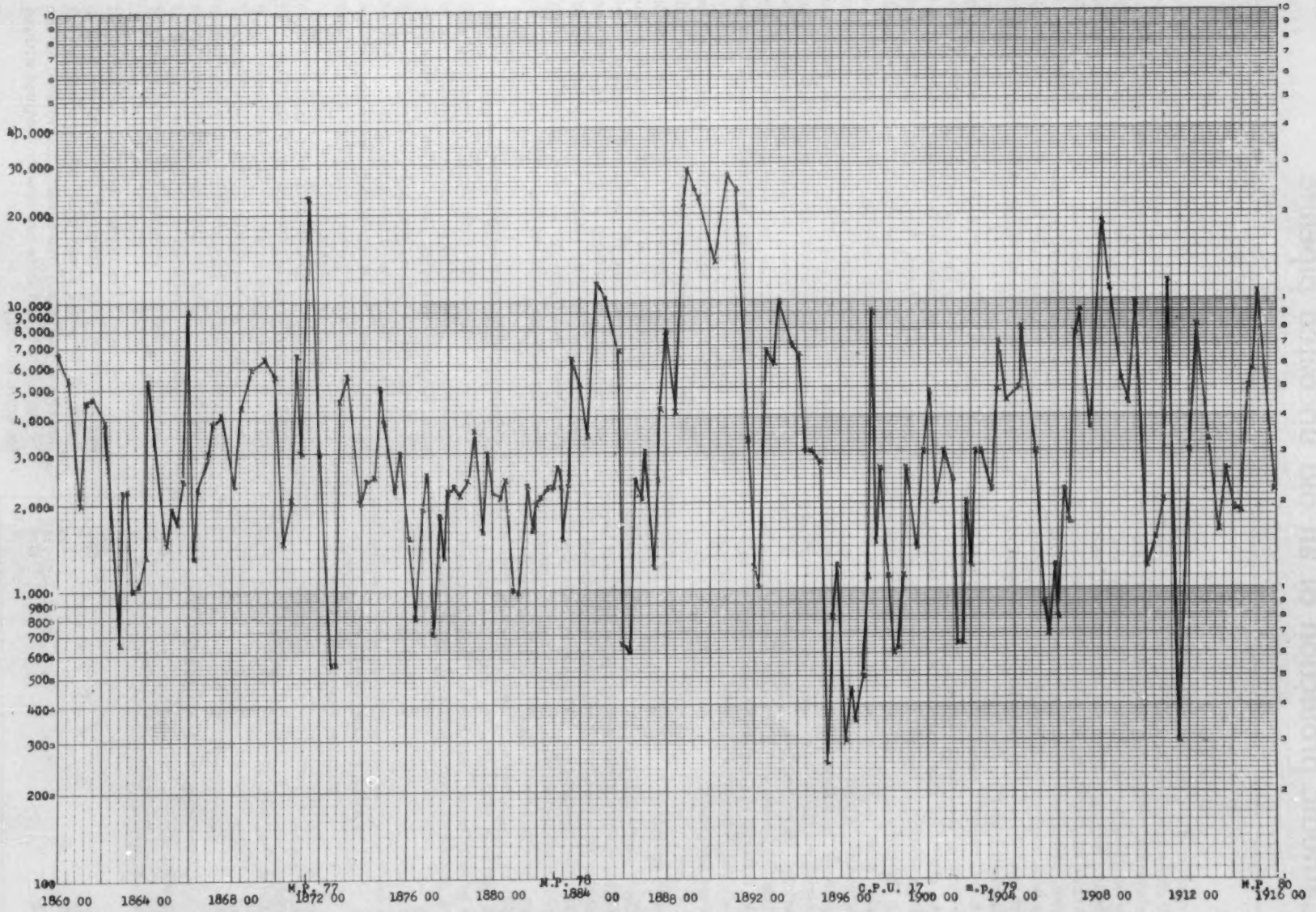

Fig. 1. Resistance sheet for section of pipeline right-of-way.

Cathodic protection of an old uncoated pipeline

particular sheet, the lowest resistivity was found to be 250 ohm-cm, and the highest was 28,100 ohm-cm. These are average resistivities to a depth of 4 ft. Resistivities on this line are as low as 50 ohm-cm and up to infinity. Although there are many abrupt resistivity changes on *Fig. 1*, no serious corrosion has been detected, principally because a cathodic protection unit has been working in this area since 1939. There have been only three corrosion leaks on the segment of pipe represented by *Fig. 1*.

A soil analysis taken in 1938 of typical soil at the west end of the line is shown in *Table 1*.

As shown by this analysis, the sulfur, sulfate and sodium content of the soil is very high. These explain why the soil can be corrosive. The water in this particular area is high in sodium sulfate and sodium bicarbonate. Alkali can be seen on the surface of the ground. It is believed that some cases of anaerobic bacterial corrosion have been found in wet swampy locations. This has been characterized by a black carbon-like substance on the pipe surface and a white milky material in some of the pits. The black substance is believed to be ferrous sulfide and the white material, ferrous hydroxide.

• Leak analysis

Fig. 2 shows that over 2000 leaks have been repaired on this line since it has been in operation. Leaks began occurring two years after the line was installed. Five years after installation, 250 blowing leaks were repaired in connection with the ditch reconditioning program. As can be seen on *Fig. 2*, it was necessary to repair only two leaks the year following this work.

It has been found that the leak accumulation curve of a predominantly bare line will form a straight line when plotted on semi-logarithmic paper. This fact enables one to predict leak occurrences after a few years, by projecting the line formed by the actual plotted leaks. The extrapolated line will very nearly predict the leak accumulation over the next period of years if conditions on the line remain unchanged. *Fig. 2* shows that if no reconditioning had been done or no cathodic protection been added to the line, the number of leaks that would have occurred yearly would have necessitated the replacement of the entire line many years ago.

If cathodic protection units had been added yearly after the first ones had been installed in 1939, the high leak rate in the period 1946 through 1954 would not have been experienced. Also, it would not have been necessary to replace all the pipe that has been replaced. However, it is much easier to draw this conclusion in retrospect than it would have been in 1940 in looking toward the future. Too often, in cathodic protection work, criticism is voiced regarding practices in force years ago when cathodic protection was in the experimental stage. Perhaps this same criticism will be voiced against present day practices at some time in the future.

Since the subject line is getting older and since the line is not completely protected, the leak rate will probably not drop significantly until the line is under complete protection. It is hoped that the leak rate can be dropped to less than 10 new leaks a year after complete protection is achieved. *Fig. 2* shows that the new leaks repaired last year (1957) were only 20. Most of these were small pinholes in seams or welds. A few were pit leaks but were not very large.

TABLE 1. SOIL ANALYSIS

SOIL (BY PERCENT)	
H_2O	22.00
Loss by Ignition	7.44
Insoluble	88.88
Fe_2O_3—Al_2O_3	2.60
CaO	0.68
MgO	0.68
Sulfur	0.80
SOLUTION (BY PARTS PER MILLION)	
Total solids	7225
SiO_2	20
Fe_2O_3—Al_2O_3	7
Ca	327
Mg	286
SO_4	5070
CO_3	0
HCO	19
Cl	14
Na-K	1415
P_h	8.15

• Cathodic protection—replacement

Table 2 outlines the cathodic protection and pipe replacement program that has been carried out to date. Although this table shows 25 per cent of the line to be coated, most of this pipe is in short segments that could not be incorporated into a new line in the event that this entire line were replaced. Only a few sections of coated pipe would be long enough to leave in place if this were done. (*Table 2.*)

The 67 rectifiers now in operation on the line are providing an average of 3300 amp of protective current which is lowering potentials to the protective criterion over 140 miles of the pipeline. This is an average of 23.6 amp per mile of pipe protected. Due to the absence of power lines along the pipeline right-of-way, it has been necessary to install comparatively high output rectifiers in order to maintain the desired spread of current.

In most cases, the ground bed and cathodic unit appurtenances were designed for rectifiers with a rating of 60 amp. These units are operated at full capacity at all times. Circuit resistances strived for are ½ ohm or less, and these are usually obtained without too much difficulty.

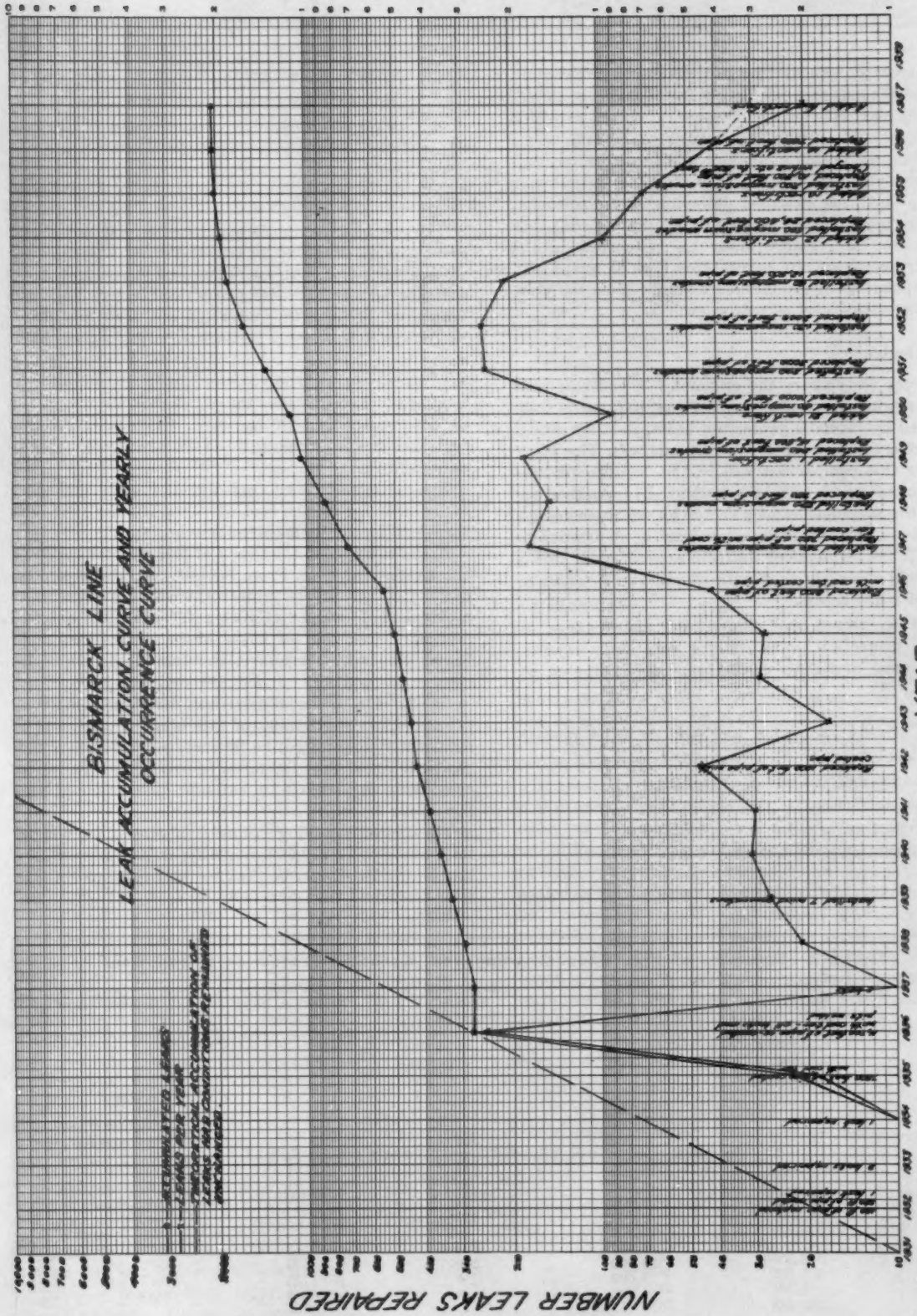

Fig. 2. Leak accumulation and yearly occurrence curve for Bismarck line.

Cathodic protection of an old uncoated pipeline

A current-pipe protection test has been conducted on many of the cathodic protection installations to determine the most efficient and economical output at which the unit should operate. In most cases, 60 amp seems to provide the optimum amount of full protection that is economically feasible (see *Fig. 3*). Any output over 60 amp has the effect of lowering the pipe-to-soil potential readings in the vicinity of the rectifier, but it does not appreciably lower the potentials in the outer fringe areas. Of course, this type of graph will vary depending on ground bed distance from the pipe, soil resistivities, cost of power, etc.

• Economics

In order to compare the economics of cathodic protection against the replacement of pipeline that is fully protected by cathodic protection units, it is necessary to select a common basis for cost analysis. The basis used for this comparison will be the "equivalent uniform annual cost" (EUAC) method. This method requires the formulation of a factor by which the original costs of certain plant assets may be multiplied to arrive at the "equivalent uniform annual costs." This factor will obviously vary with the different classes or types of plant assets.

Based on recent cost figures for maintenance of cathodic protection units and for pipe replacements, factors used in EUAC calculations are computed as follows:

(1) Cathodic protection rectifiers on REA power:

Cost of money	0.07
Taxes and insurance	0.02
Depreciation	0.10
Power costs	0.20
Operation & Maintenance	0.11
	0.50 or 50 per cent

(2) Pipeline replacement:

Cost of money	0.07
Taxes and insurance	0.02
Depreciation	0.02
	0.11 or 11 per cent

The operation and maintenance of a pipeline replacement are not included in the 11 per cent pipeline replacement factor, but operation and maintenance are included in the cathodic protection factor. This has been done because the operation and maintenance of the line is considered to be unchanged before and after cathodic protection is added except for the extraordinary maintenance. The extraordinary maintenance is assumed to have justified the use of cathodic protection or the replacement of the pipe. Cathodic protection costs are balanced against the extraordinary maintenance only.

The salvage obtained from the old pipe is considered to be balanced by the cost of removing the pipe, and therefore is not included in this analysis.

As an example of the usage of these factors, we will choose the year 1956. From *Table 3*, 62 cathodic protection units collectively protect 116 miles of pipeline to a potential of —0.80 v ($CuSO_4$ reference). The original cost of installation of these units is an average of $1600 per unit. Therefore, the cost of 62 units is:

62 x $1600 = $99,200 original cost

Of the 116 miles of pipeline that are completely protected, about six miles of this pipe is coated and of sufficiently long length to be incorporated into a new pipeline. Therefore, 110 miles of protected pipe can be considered replaceable if cathodic protection of this pipe were ceased.

The cost of installing 110 miles of pipe at $25,000 per mile would be $2,750,000. Actually, this would now be a low figure, but it can be used for this comparison. The EUAC's would then be:

TABLE 2—Summary of Pipe Reconditioning and Cathodic Protection Installations

Year	Ditch Coating, ft.	Pipe Replaced, ft.	Magnesium Anodes Installed	Cathodic Protection Units Installed	Average Amperage Drainage Per Year
1932	920	180			
1935	11,700				
1939				7	Variable with wind
1942		1,000			Minimum 0 amps
1946		8,100			Maximum 600 amps
1947		750	750		
1948		750	320		
1949		15,500	240	1	
1950		10,000	80	21	150 + variable
1951		9,000	200		640 + variable
1952		2,000	120		640 + variable
1953		12,500	60		640 + variable
1954		24,400	600	13	1410 + variable
1955		35,000	200	10	1970
1956		7,000	0	10	2610
1957		1,400	0	5	3300
27 years		24.8 miles	2570	67	

Cathodic protection units:

$99,200 x 0.50 = $49,600 EUAC

Pipeline replacement:

$2,750,000 x 0.11 = $302,500 EUAC

As can be seen, cathodic protection costs are about one sixth of pipeline replacement costs on an equivalent uniform annual cost basis.

Of course, this analysis does not take into account the fact that much pipe is partially protected and that a new line would also require maintenance and cathodic protection. However, to balance this, there is the fact that a new line would be much more dependable from a pressure standpoint.

The EUAC comparison for each year starting with 1954 is shown in *Table 3*.

To justify the installation of one rectifier to the line, the amount of pipe that it must protect to be economically feasible can be found as follows:

$$1600 \times 0.50 = \$800 \text{ EUAC for one rectifier}$$

$$\$25{,}000 \times 0.11 \times (\text{miles}) = \$800 \text{ EUAC for pipe replacement}$$

$$\text{miles} = \frac{\$800.00}{\$25{,}000 \times 0.11}$$

$$\text{miles} = 0.29 \text{ miles of pipe per unit}$$

Therefore, it can be concluded that a rectifier is justified if it can reasonably be calculated that it will protect at least 0.29 miles of pipeline. The average amount of protection per rectifier being achieved is about 1.8 miles per rectifier so that the present units are justified by a wide margin.

Another way of looking at the problem of justification of the addition of more rectifiers is as follows: If a rectifier with an EUAC of $800 can prevent four leaks per year at $200 per leak, the installation is justified. Since four leaks per year are apt to develop on any part of this line in a 1.8-mile section, the installation of each rectifier is considered to be justified from a leak repair cost standpoint. Generally speaking, it is not planned to wait for leaks to appear in a certain section where they have not yet appeared before protecting it. Since only a small part of the line remains to be protected, units will be added until the complete protection of all the pipeline is achieved.

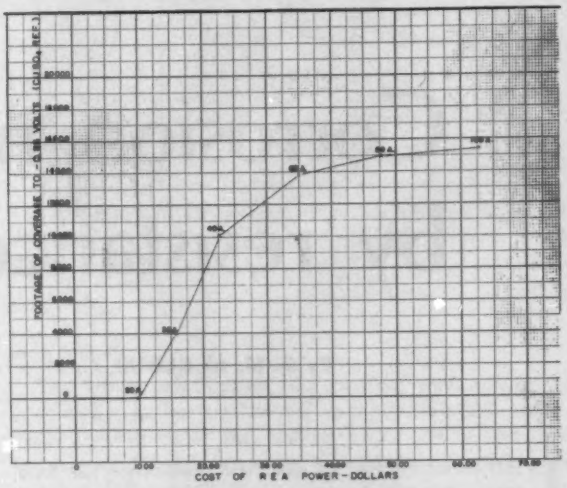

Fig. 3. Monthly power cost vs. footage of pipe protected for Bismarck line C. P. U. 110. Current outputs are shown.

• Conclusion

The foregoing has been a case history of the application of "hot spot" coating and cathodic protection to an old predominantly uncoated line. It is felt that approximately the same results and the same amount of success can be achieved on most old bare lines provided that they are of sufficiently good condition to meet the future pressure demands.

It must be understood, however, that each pipeline will present a slightly different problem because of the many variables which come from change of locality and differences in pipeline sizes. Before going into a cathodic protection program of the magnitude presented in this article, it is suggested that the economics be thoroughly worked out before the program is started. This must, of course, be based on current requirement tests, power costs, resistivity surveys, power availability, and many other factors peculiar to each locality. With costs of material and labor rising constantly, cathodic protection of existing bare lines is becoming more and more attractive from a financial standpoint, and should be considered before replacing an existing pipeline. ■

TABLE 3—Bismarck Line Cathodic Protection Analysis

Year	Number of Rectifiers	Amperes Drainage at Time of Survey	Amount of Pipe Protected to — 0.80 Volts ($CuSO_4$ Ref.) Miles	EUAC Rectifiers	EUAC to Replace Protected Pipe	Per Cent of Line Protected
1954	36	1550	56	$27,000	$162,500	31.5
1955	52	2375	98	41,600	255,400	56
1956	62	3200	116	49,600	302,500	66
1957	67	3500	140	53,600	385,000	80

NOTE: An average of 24 to 28 amp are required to raise one mile of pipe to complete protection.

Corrosion measurement by resistance method

By D. M. McCLOUD, Crest Instrument Co., Santa Fe Springs, Calif

THE measurement of electrical resistance has long been used (*Ref. 1-9*) to determine the extent of corrosion on metal specimens. Only recently, however, has work been done to develop a method which would find use in measuring corrosion in a variety of industrial processes.

In order to have wide application and acceptance as a practical method, resistivity measurements on a metal specimen must be made independent of the temperature at which resistance is determined. Furthermore, the method should permit measurement without removal of the specimen from the corroding environment.

Such a system has been developed and is referred to as the Corrosometer method. Readings are made directly on metal specimens without their removal from the corrosive medium. These readings are essentially independent of the temperature and nature of the corrosive medium.

The Corrosometer method for measuring corrosion involves installing a special probe in the system under study, and following the progress of corrosion on the probe electrically by means of a special meter. This special probe consists essentially of an exposed metal specimen which is made part of an electrical circuit used to make resistance measurements on the specimen. The exposed specimen is made of whatever metal is of interest, and the corrosion measured is that which takes place directly on this specimen.

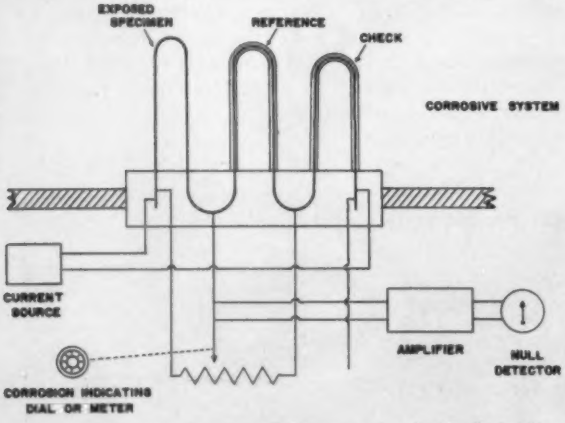

Fig. 1. Schematic diagram of Corrosometer electrical circuit.

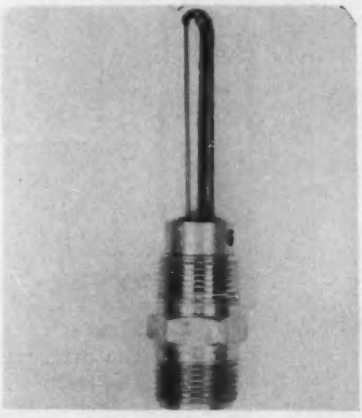

Fig. 2. Probe design for a pressure system.

The operation of the Corrosometer is based on the fact that the electrical conductivity of most metals is very great, while the conductivity of non-metals is negligible by comparison. As the corrosion process converts metal into non-metal, electrical resistance of a piece of metal thus increases. The meter circuit utilizes this change of resistance to indicate the extent of penetration by corrosion on an exposed metal specimen.

The resistance of this exposed specimen is not measured directly by the meter circuit, however. Instead, a second specimen, made from the same metal or alloy, is connected in series with the first and the two specimens are made part of a bridge circuit. The second specimen is covered with a highly corrosion resistant coating and so retains its original cross section and resistance. The ratio of the resistance of the exposed specimen to that of the covered specimen is then determined. Changes in this resistance ratio are

translated directly into units of corrosion by the meter circuit.

Because the circuit measures only the ratio of the two resistances, the measurements are essentially independent of the current used to energize the bridge.

Likewise, because temperature changes affect the resistance of both exposed and covered elements in the same manner, the resistance ratio and the meter reading are independent of the temperature of the environment. It is this self-compensating feature of the bridge arrangement that permits the high degree of sensitivity and great versatility of the method.

A simplified schematic diagram of the electrical circuit through the probe and meter is shown in *Fig. 1*. The exposed specimen is the element on which the progress of corrosion is to be followed. The reference specimen has a protective coating and is connected as shown in *Fig. 1* when a corrosion measurement is

Fig. 3. Portable meter for reading probes.

made. The position of the slider at bridge balance is indicated by a dial on the control panel. By use of appropriate circuitry, the position of the slider is made to indicate directly the linear penetration related to the resistance change for specimens of different shapes (e.g., wires, strips, and tubes).

The third loop in *Fig. 1*, "check," is used for checking the resistance of the reference specimen. In field tests, it is often important to know that the coating on the reference specimen is in good condition and that any change in meter reading is a result only of corrosion on the exposed specimen. A "check" reading is accomplished by connecting the reference and check specimens in the bridge circuit and measuring their resistance ratio. (Manner of connection for check reading is not illustrated in *Fig. 1*.) Inasmuch as the check specimen is also covered to prevent it from corroding, the reference to check ratio should not change throughout the life of the probe.

CUMULATIVE MILS CORROSION BY CORROSOMETER MEASUREMENT	TOTAL GRAMS LOSS		INCREMENTAL GRAMS LOSS	
	CALC. FROM CORROSOMETER	MEASURED	CALC. FROM CORROSOMETER	MEASURED
1.3	1.1	1.05	1.1	1.05
4.6	3.9	3.91	2.8	2.86
7.6	6.2	6.06	2.3	2.15
13.2	9.9	10.04	3.7	3.98
19.5	13.3	13.25	3.4	3.21

Fig. 4. Comparison of measured weight loss with loss calculated from Corrosometer readings for mild steel wire corroded in 2N NHO_3 at 75° F.

• Probes

The probe containing the exposed and reference specimens can be constructed in many different ways. Both conditions of the system under study and the purpose of the testing enter into the requirements of construction needed to produce a suitable probe. The characteristics of the corrosive system primarily influence the mechanical construction of the probe and materials used for support and insulation, whereas the purpose of application mainly influences the composition and size of exposed specimens.

It was quickly found that one specific form of specimen (e.g., wire) would not provide the maximum use for the Corrosometer method. Not all alloys are readily available in one specific form, and one form does not give the optimum performance relative to both sensitivity and corrodible life. Accordingly, circuits were included in the meters to follow the linear corrosion for the three commonly available shapes of metal, namely: round wire, flat strip and thin walled tubing. Wire specimens provide the longest life for a given cross-sectional area of the element, and are particularly suited for long range testing and collection of control data. Strip specimens give maximum response to corrosion because they can be made from material as thin as 0.001-in. and are particularly useful for short range tests and laboratory studies. Tubing affords fairly rapid response combined with ruggedness. Tubing specimens find use where high fluid velocities might damage less rigid strip specimens and yet where higher

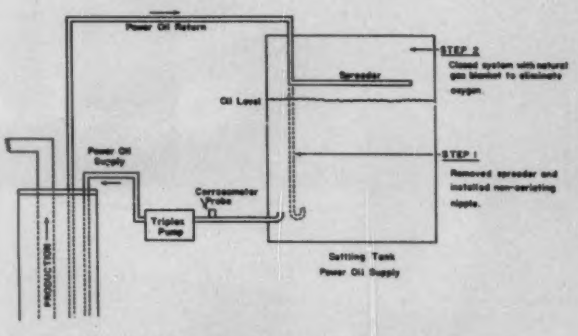

Fig. 5. Schematic diagram of power oil system.

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90° Elbows, Short Radius	14	2"	90°	X-STG	1-R		WeldELLS
45° Elbows	6	3"	45°	XX-STG			WeldELLS
90° Reducing Elbows	3	4x2"	90°	STD			Reduc WeldELLS
90° Long Tangent one end	2	5"	90°	X-STG			WeldELLS, Tan one end
90° Long Tangent both ends	8	6"	90°	STD			WeldELLS, Tan both ends
180° Returns, Long Radius	12	8"	180°	LIGHT WALL	LR		WeldELLS
180° Returns, Short Radius	16	10"	180°	STD	1-R		WeldELLS
Tees, Straight	3	12"		SCH 40		See	Tees
Tees, Reducing	1	14x14x10"		SCH 20		(1)	Reduc Tees
Reducers, Concentric	2	16x14"		SCH 30		below	Con Reduc
Reducers, Eccentric	9	12x8"		SCH 60			Ecc Reduc
Lap Joint Stub Ends	14	18"		SCH 80			LJ Stub Ends
Caps	24	10"		SCH 100			Caps
Crosses, Straight	3	8"		STD			Crosses
Crosses, Reducing	2	4x4x2x2"		X-STG			Reduc Crosses
45° Laterals, Straight	1	4"		STD			Laterals
45° Laterals, Reducing	6	6x6x4"		X-STG			Reduc Laterals
Welding Saddles	21	8" on 10"					Saddles
Welding Sleeves	50 sets	6"					Sleeves

(1) When ordering regular carbon steel fittings material need not be specified and fittings conforming to ASTM A234, Grade WPB, will be furnished. Any other material must be fully identified by applicable specification.

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90° Elbows, Short Radius	1-42	1½-8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1¼-24
45° Elbows	½-42	1-8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1-24
90° Reducing Elbows	2-16			8-16	12-16						
90° Long Tangent Elbows	1½-42			8-30	12-24						
180° Returns, Long Radius	½-30	1-8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1-24
180° Returns, Short Radius	1-42	1½-8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1½-24
Tees, Straight & Reducing (3)	½-36	¾-8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	¾-24
Reducers, Conc. & Ecc. (3)	¼-42	⅜-8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	¾-24
Lap Joint Stub Ends	½-42	½-8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1-24
Caps	1¼-24	1-8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1-24
Crosses, Straight & Reducing (3)	1-24										
Laterals, Straight & Reducing (3)											
Welding Saddles											
Welding Sleeves											

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sensitivity is desired than that provided by wire specimens.

The pattern of construction from the sample specimens depends entirely on the application intended for a specific probe. For laboratory testing, completion will involve only casting the lead end in a suitable plastic for support and protection of electrical contacts from corrosive solution. For field testing in open systems, an extension cable may be joined to the probe before casting and a slotted shield fitted around the exposed and reference specimens if protection is required. For pressure systems, several probes have been developed to cover the wide range of conditions encountered.

One probe design for a pressure system is shown in *Fig. 2*. In this probe, the metal specimens have been incorporated into insert units which terminate in a special metal fitting which serves both as a pressure seal and as a receptacle for the meter connections. These inserts, equipped with suitable O-rings, slip into stainless steel housings that in turn are inserted into the system under study. The probe is fitted directly into the system by means of the threaded member on the insert end.

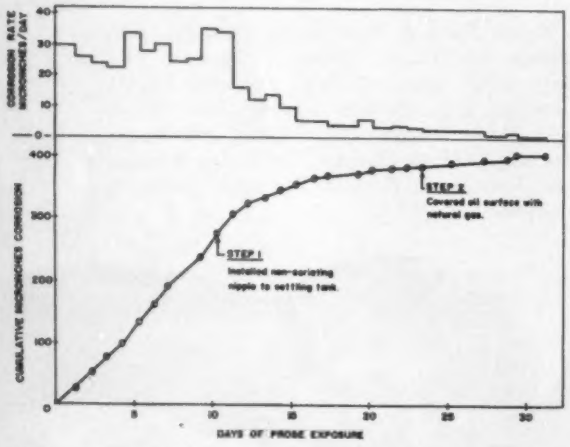

Fig. 6. Effect of oxygen removal on corrosion rate of steel in power oil system.

• Meters

The portable meter for reading probes is shown in *Fig. 3*. This meter (Model CK) can be operated either from a line source or by self-contained batteries. Readings are given directly in microinches and separate circuits are provided for wire, tube and strip specimens in the probe.

An antomatic balancing and recording system (Model L) has also been developed. With one basic indicator and servo unit and program unit, up to 12 different probes can be automatically monitored. The cumulative corrosion is given by corrosion dials and is continuous throughout the life of the probe. The "in-progress" corrosion is given by a resettable short span corresponding to 10 units of the corrosion dials (10 microinches for 4 mil strip specimen). The output of this short span can be connected to a recorder to give a permanent record of the corrosion rate. The recorder is reset automatically.

• Interpretation of data

The Corrosometer method is basically a resistance measuring system and, as such, will indicate corrosion as the corrosion process causes the resistance of the exposed probe element to increase by removing metal from the surface of the element. The instrument responds to the resistance of the exposed sensing element as a whole, with the result that any loss of metal is indicated as if the loss had occurred uniformly over the entire surface of the element. Thus, the resistance measurement has an averaging effect and in this respect gives the same kind of data as is obtained by weight-loss measurements.

The data in *Fig. 4* illustrates the good correspondence between resistance and weight loss data. In this study, a probe made from 80 mil steel wire was placed in 2 N nitric acid at 75° F and approximately 20 mils of corrosion penetration was permitted to occur. (Reduction of wire to one-half of its original diameter.) At intervals, the penetration by the Corrosometer method was recorded and the probe quickly removed, washed, dried and weighed. The weight loss calculated from resistance measurement, assuming uniform penetration along the specimen, was compared to the measured weight loss.

It is to be noted that comparison of the calculated and observed weight loss between successive points does not give as good a correspondence as does the cumulative data. This observation, of course, is to be expected because the errors in data points used for differences become a smaller percentage of the total as the data points are more widely separated.

The principle of averaging data for most meaningful results also applies to Corrosometer readings. Thus, corrosion rates should not be calculated by taking individual differences between each successive pair of readings. This method of treating the data tends to magnify small deviations out of proportion to their true meaning. Instead, the individual readings should be plotted against time. After a number of points have been plotted, the best smooth line is drawn through the points and the corrosion rate may be determined as the slope of this line at any point. After such plots have been established and maintained for a period of time, the corrosion behavior at each probe location will be evident from inspection of the curves.

• Field tests

Many hundreds of tests have now been carried out using the Corrosometer method for establishing corrosion rates. Three of these studies are described below to illustrate the use of this method of measurement under a number of widely different systems.

Power oil system. This system consisted of storage tank, pump and supply lines used to provide power oil for operation of an oil well pump. *Fig. 5* shows schematically the arrangement of the system and the location where a probe was installed.

Fig. 6 shows both the cumulative corrosion readings taken throughout the test and the corrosion rate calculated on the basis of successive readings. (It is apparent that a corrosion rate calculated the slope of the curve would have given a more representative value than the rate calculated between each reading.)

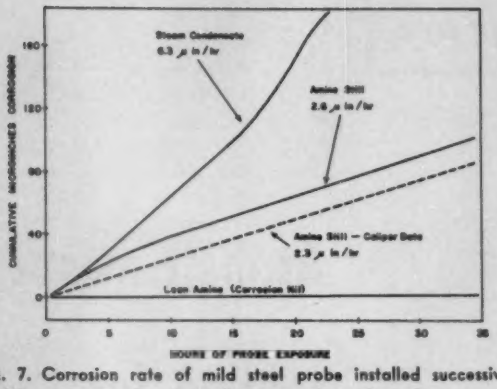

Fig. 7. Corrosion rate of mild steel probe installed successively in different parts of amine still in natural gasoline plant.

The operators suspected that oxygen picked up at the spreader in the storage tank was the cause of the high corrosion rate established by the probe. The first step in corrosion mitigation involved installation of a non-aerating nipple in place of the spreader. This step greatly reduced the pickup of air and, as shown by *Fig. 6*, materially reduced the corrosion rate on the probe. The second step proved complete exclusion of air from the system by covering the oil surface with a blanket of natural gas. This step resulted in reducing the corrosion rate to a negligible value.

Amine adsorption system. This system was a part of a natural gasoline plant where acidic components were removed from natural gas by a counter flow adsorption with monoethanolamine. The process consisted of a lean amine feed from the still to the adsorber, a rich amine feed from absorber to still, and a steam condensate from the still. Pertinent data are as follows:

H_2S Content of Gas	1½ per cent
CO_2 Content of Gas	2 per cent
Lean Amine	Cool, atm
Amine Still	245°F., 10 psig
Condensate	210°F., 2 psig

A single probe was installed successively in the three separate parts of the system: Lean amine line, amine still and condensate line. Results* of this study are shown in *Fig. 7*. As might be expected, no corrosion was found in the lean amine line; whereas a high corrosion rate was found in the amine still and in the steam condensate where acid components would be found. It is interesting to compare the corrosion rate found for the amine still to that calculated on the basis of a micrometer and caliper survey made on this same system. The caliper survey was made after 18 months operation and gave a corrosion reading of 2.3 microinches per hour.

Process Water. Fig. 8 shows the behavior of three mild steel probes placed in a slightly acidic process water. This data is presented to illustrate that not all probe readings fall in a smooth, straight line pattern. Although the cumulative corrosion for each of the three probes is similar after 60 days exposure, the day to day rates are often widely different.

This response is typical of oxygen containing systems and where erosion as well as corrosion influences removal of metal. Products of corrosion, such as metal oxides, build up on the metal surfaces tending to hinder further corrosion. Fluid motion or erosion by solid particles, however, is active in removing these deposits and corrosion will start anew when fresh metal surfaces are exposed. Early in the exposure life of these probes, process changes in the flow lines could sometimes be detected by day to day readings (not shown on graph) of the probes. After 2 or 3 weeks exposure, however, these changes in corrosion rate by process differences were masked by larger corrosion variations related to changes in surface deposits.

Fig. 9 shows the readings of three probes constructed with specimens having different metal composition and exposed at a highly corrosive location in this process line. The relative corrosion behavior of mild steel, phosphor bronze and stainless steel can quickly be ascertained, which provides valuable information for equipment design. ■

*Courtesy of E. O. Kartinen and P. W. Hill, Signal Oil & Gas Co.

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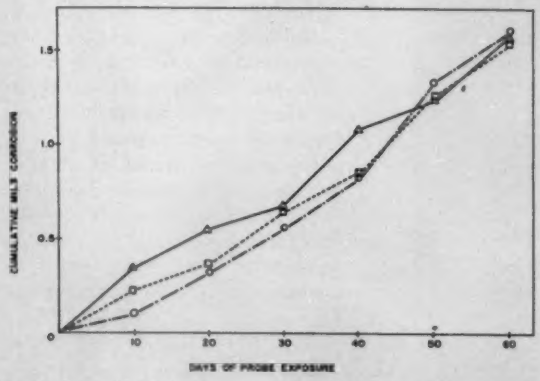

Fig. 8. Corrosion behavior of three mild steel probes in process water line.

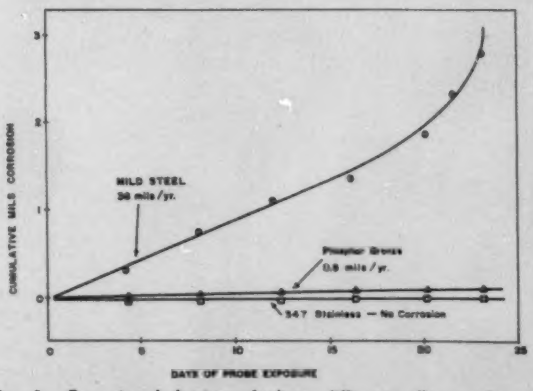

Fig. 9. Corrosion behavior of three different alloy probes in process water line.

Asphalt mastic coating for offshore lines

By L. N. BROWN, Chief Engineer
Southern Natural Gas Co., Birmingham, Ala.

WHILE Southern Natural Gas Co. had very little, if anything, to do with the development of high density asphalt mastic coating and its method of application, we were cognizant of the need for a coating that had flexibility and ductility and one that could be applied to the pipe on location immediately prior to laying. The use of yard-coated concrete jacketed pipe entailed numerous and costly handlings with attendant damage to the coating and the necessity of applying an expensive coating to the field weld before the pipe could be lowered to the bottom of a pre-dug canal or other water bottom.

In 1953 Southern Natural installed approximately 200 miles of pipe in the marsh, swamp and offshore areas of south Louisiana. The pipe sizes varied from 4½-in. OD to 20-in. OD. Practically all of the pipe was installed in brackish or salt water which required not only a weight coat but

Overall view of welding barge and coating barge. Shuttle and supply barges are tied to coating barge.

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No. 3 seamless mill, Indiana Harbor, Indiana. Fully automated, ultra modern mill . . . began operating September 30. Contains world's largest Rotary Billet Heating Furnace . . . adds to our over-all capacity in both alloy and carbon casing. Offers API casing in sizes 4½", 5", 5½" and 7", in grades H-40, J-55, N-80, in ranges 2 and 3 . . . plus line pipe in sizes 4½", 5⅝" and 6⅝" O.D. in grades A, B, X-42, A106, A53 in single and double random lengths. Photo shows Rotary Furnace in foreground.

Upset finishing mill, Youngstown, Ohio. Also a fully automated mill began operations September 15. Contains a pair of automatic upsetters with attendant furnaces plus a full-length normalizing furnace for highest quality control of all products. This mill adds to our capacity for Drill Pipe in grades D, E, x-95 and in Upset Casing (Speedtite). Photo shows upsetter and control panel in foreground, normalizing furnace in left rear.

also one that would act as a corrosion preventive.

At that time, the only available coating which answered that need was a combination of enamel for corrosion prevention and a steel reinforced concrete jacket for weight. It was not thought that the concrete jacket, due to its water absorption qualities, added anything particularly to the corrosion protection except as a partial deterrent to attacks from marine organisms.

Rigid specifications were prepared to cover the application of these coatings, which consisted of coal-tar primer over which was applied a hot double coating of semiplasticized coal-tar enamel with an underground fiber glass pipe wrap pulled into the first coat and over the double enamel coat a spiral wrap of fiber glass outerwrap applied in both instances while the enamel was still hot. Over this protective coating, a steel wire reinforced concrete jacket was installed which varied in thickness between 1 in. and 2.25 in., dependent on pipe size and weight required. Specific gravity of the pipe and coating varied between 1.25 and 1.40, depending on the area where the pipe was to be installed and the soil conditions found at these locations. It was necessary that this coating work be performed in a coating yard and the pipe transported to the job by barge. This entailed considerable handling with consequent damage to the coatings before the pipe was received at the job site. Delays in laying operations and the expense of making costly repairs to the coating, plus the care and preparation required in order to get the pipe in its final resting place without unduly cracking the coating, caused the germination of an idea for a weight coating that could be applied on the job and one that was also a protection against corrosion and had sufficient ductility and durability so that it could be lowered to any bottom depth without cracking or damage.

The study and further development of this idea was undertaken by Gen. P. H. Timothy, a member of Southern Natural Gas Co.'s engineering staff at that time, who had been the company's project engineer during the 1953 construction program. During the course of the study and investigation of the possibilities of a job site application of a coating of this type, the work was taken over by Southern Production Co. who later joined forces with Brown & Root, Inc., in the development of the mixture and equipment for applying the coating.

After several years of work and experimentation it was found that a combination of base asphalt refined from salt free crude, a coarse aggregate of sand and/or heavy weight material, a mineral filler, a binder of emulsified asphalt mixed with hard asphalt and synthetic rubber, an internal reinforcement of chopped fiber glass strands and an external reinforcement of fiber glass mesh furnished the type of coating that was sought. The coating was named "Timcoat" in recognition of Gen. Timothy's ideas and work on the development of the process.

The development of the coating machine was a very tedious and time-consuming project. Inasmuch as a machine of this nature had never been built before, it was necessary to invent, improvise and adapt other machinery and equipment to prepare the mixture for application and get it on the pipe in such a manner that it would bond with the pipe and have the other attributes of a desirable coating.

The preliminary work of designing the equipment was done in New Orleans and late in 1955 a pilot plant was completed and the first joint of pipe satisfactorily coated. After this start, Gen. Timothy and his co-workers went on with the design and creation of the coating plant complete with the coating machine and batch mixing equipment which will be subsequently described in more detail.

This second phase of the project was completed in early 1956 and a trial run on 12-in. pipe indicated that it could be successfully coated and the time element was such that the operation would readily lend itself to a field coating job. Shortly after this demonstration, Brown & Root was successful in bidding a pipeline project for Southern Natural. It was then decided to coat the pipe with Timcoat.

This work, on which Timcoat was used, consisted of the installation of approximately 30 miles of 12.75-in. OD and .75 miles of 8⅝-in. OD gas pipeline in the marsh area south of New Orleans.

Pipe is cradled into the water from the coating barge.

After the decision to use Timcoat was made, all of the equipment was moved from New Orleans to Brown & Root's Houston yard for mounting on barges in preparation for the job.

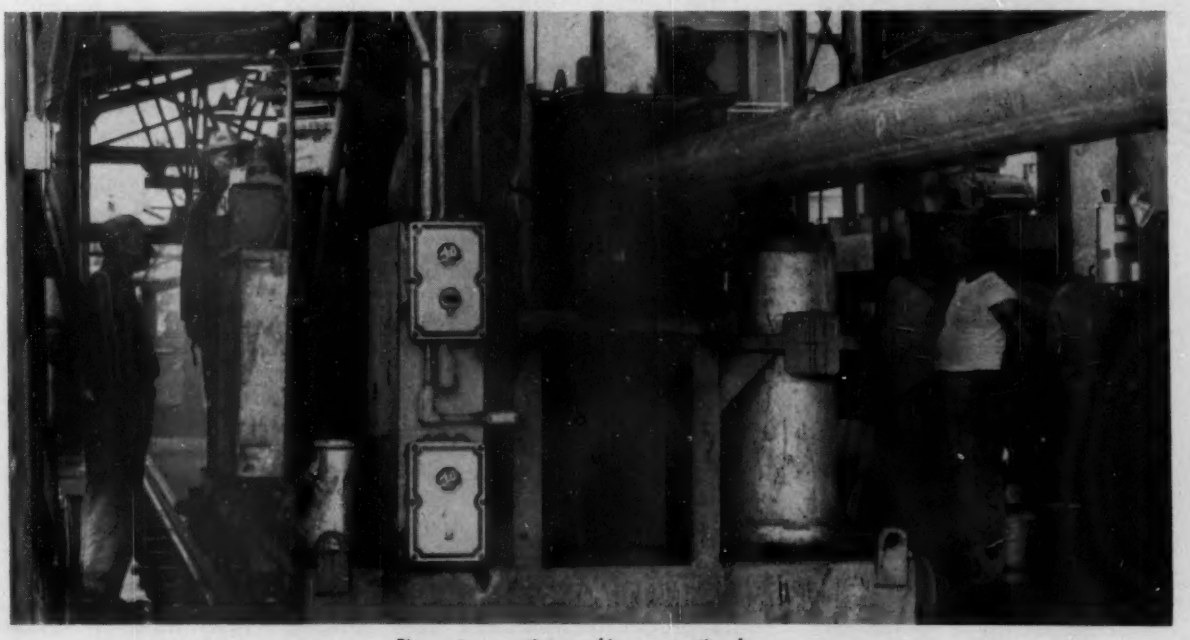
Further development, testing and improvement of the coating itself were continuing while the barge mounting and perfecting of the coating equipment was in progress. The mixture finally decided upon consisted of coarse and fine aggregates, a rubberized asphalt binder, and an internal and external reinforcement with the combination of ingredients being varied to suit various laying conditions or requirements.

Two types of aggregates, a coarse aggregate and a fine aggregate to fill the voids in the coarse aggregate, are used in Timcoat. The coarse aggregates are silica sand and/or heavy weight material such as barite, which is ground so that it will pass through a .25-in. screen. The fine aggregate, or filler, consists of pulverized limestone or pulverized barite similar to that used in drilling mud.

The weight of the coating mixture can be varied between 136 lb and 230 lb per cu ft by blending the proper percentages of light and heavy weight aggregates. The

Coated pipe is cooled immediately after it leaves the coating machine.

136-lb mix consists of sand as the coarse aggregate with a limestone filler. The heavier mixes are obtained by replacing part of the sand with barites in increasing amounts and then by replacing the light weight or limestone filler with powdered barite. The maximum density product is obtained by using 100 per cent barite for the coarse aggregate and 100 per cent pulverized barite for the fine aggregate. The voids in the fine aggregates in all of the various weight mixtures are filled with a rubberized asphalt binder which consists of an emulsified asphalt mixed with hard asphalt to form



Pipe enters coating machine on coating barge.

Shuttle barge is hauled from the dry mix plant to coating barge.

a blend which is then amalgamated with a synthetic rubber.

The base asphalt is emulsified by the use of an agent consisting of a metallic soap which is especially designed for water application and which produces a coating having superior weathering characteristics than a coating prepared from the base asphalt alone. The quality control of the base asphalt conforms to the specifications prescribed by Cathodic Protection Service of Houston, who were assigned the task of developing this ingredient. The specifications prepared from this study and experiments require that, among other qualities, the base asphalt be refined from crude oils in which the salt content does not exceed 50 lb per 1000 bbl. Their investigations found that the salt content of asphalt largely controls water absorption which then determines the durability of the electrical resistivity of the coating. By desalting the crudes to the above limits, the water absorptive rate of the base asphalt becomes conformable or less than that of coal-tar.

A dry powdered asphalt is blended with the emulsified or base asphalt to increase the stability of the coating. A mixture prepared with the emulsified asphalt alone was found to be too soft since it had a high penetration rate and too low a softening point for a satisfactory coating. When the stability was increased by blending with powdered asphalt, the softening point of the resulting mixture was raised and the penetration rate decreased. The greater the stability of the resulting blend, however, the more brittle it becomes; therefore, in order to obtain the maximum stability, and also to prevent embrittlement, the asphalt blend is rubberized with a synthetic rubber additive.

As previously mentioned, the desalting of the crude oils used in the preparation of the asphalt binder helps to remove the tendency of the binder to absorb water and by the addition of the rubber additive, the binder is further waterproofed. This rubber additive also increases the ductility, raises the softening point temperature of the coating and toughens the coating with respect to its penetration qualities.

Tests made by the Chicago Testing Laboratories show that by amalgamating five per cent rubber with an 80 penetration asphalt, the softening point temperature was increased from 123° F to 152° F, the penetration at 77° F was decreased from 80 to 64 and at 115° F the penetration was changed from "too soft to measure" to 180 and the ductility at 32° F was increased from 0 to 150 plus.

It is also interesting to note that tests by the research division of Goodyear Tire and Rubber Co. show that the dielectric strength of the rubberized asphalt is about twice that of coal-tar and that it compares favorably with the commonly used insulating materials except chlorinated rubber. It exceeds vinyl, hard rubber and asbestos filled Melamine resin.

Another marked effect of the addition of synthetic rubber is the increase in the adhesive qualities of the binder with respect to the aggregates and of the overall coating with respect to the pipe surface. In fact, it was found that the Timcoat made a better bond to the pipe by itself than when various types of primer were used prior to the application of the Timcoat.

As the mixture is being heated, immediately before application to the pipe, an internal reinforcement consisting of chopped fiber glass strands is added which performs two main functions. The first and most important is the increase in hot stability which prevents the flow of the hot coating to the bottom of the pipe as it is applied, and the second benefit derived is the increased resistance to cold flow. The glass reinforcement also adds to the toughness and stability of the coating. Tests made by Pittsburgh Testing Laboratory showed

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that the addition of the glass fiber, together with the rubber additive, increased the unconfined compression strength of the coating by as much as 70 per cent.

After all of the component parts have been added and the mixture raised to an application temperature of about 260° F, it is applied to the pipe by extrusion and an outerwrap of glass reinforcement is then spiralled on the coated pipe under tension. This outerwrap counteracts any tendency the material may have to flow when hot and also increases the coating resistance to abrasion and impact forces.

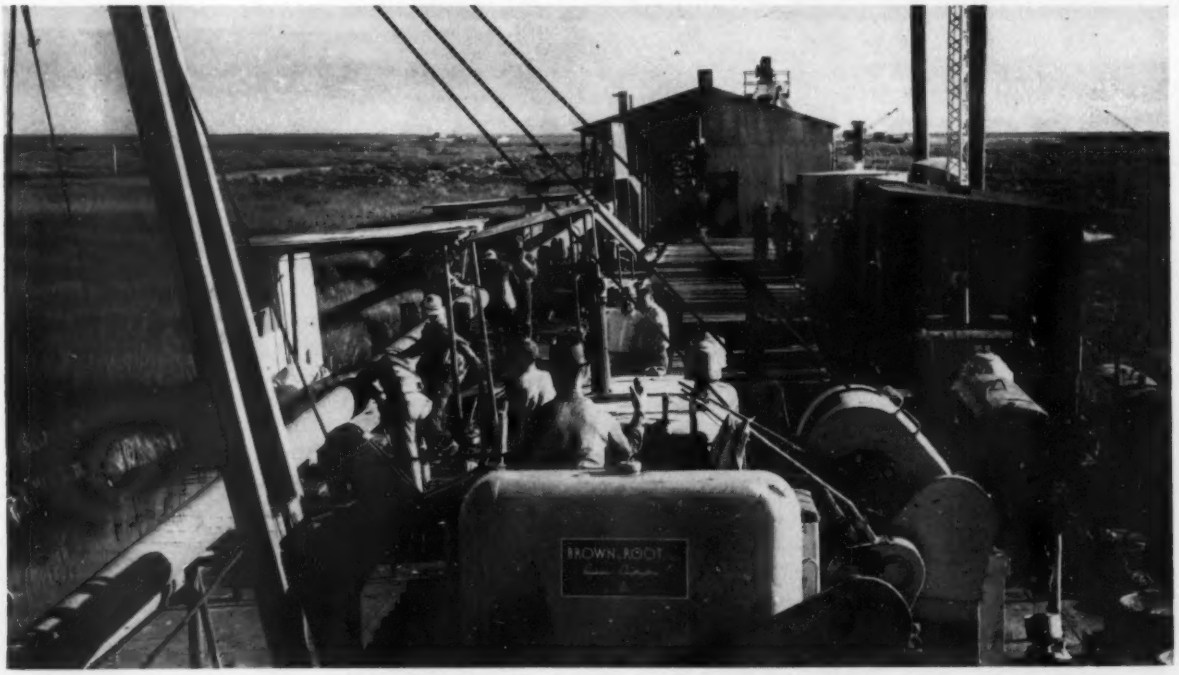
Before describing the coating equipment, it might be of interest to give a brief description of some of the tests made and results of the tests on pipe and pipe specimens coated with Timcoat.

The first test consisted of four specimens of 8⅝-in. pipe installed in February, 1956, near the mouth of Bayou Caddy on the Mississippi Gulf Coast in an area known to be infested with the usual marine organisms which are known to be detrimental to pipe coatings. It was anticipated that if no significant decrease in the electrical resistance of the coating was observed with time, the results would indicate that the coating would withstand any significant destruction as a result of attack by marine organisms. The ends of the pipe specimens were sealed with plastic caps and thoroughly checked by the use of an especially designed holiday detector operating at a no-load peak voltage of 38,000 volts. Two of the test specimens were connected to a magnesium anode and the other two were connected to a small battery charger in connection with a graphite ground anode. The potential impressed on the two samples connected to the magnesium anode was 1.5 volts and on the two samples connected to the graphite anode 7.8 volts. At the time of the installation no current drain could be observed from any of the samples by use of the highest precision instruments. Subsequent checks made in the spring and summer of 1956 by Cathodic Protection Service, who had been assigned to the testing work, found that no detectable current flow could be measured. Visual inspection of the specimens showed them to be covered with barnacles and oysters but no visual evidence of teredo attack could be found.

Rechecks on Feb. 11, and in late July 1957 again showed no perceptible current flow, and therefore indicated that coating resistance on these samples, after a year and a half of exposure, is still infinite.

Since the time of the installation of these first test specimens, other specimens have been placed in offshore waters of the Gulf of Mexico consisting of one set near an offshore drilling platform and another set in Aransas Pass off the Texas Coast. In addition to these, other specimens have been placed in Lake Maracaibo in an area known to be infested with marine organisms, including marine borers.

Tests were also made by Cathodic Protection Service on the 12- and 8-in. Timcoated pipelines, previous mentioned, that were installed for Southern Natural in 1956. The first test was made on a 3700-foot section of 8-in. pipe. The overall resistivity of this section was found to be 540,000 ohms per square foot. After the entire system had been laid, essentially the entire line was energized and tests made and the overall average resistance was found to be 148,000 ohms per square foot. The reduction in the overall resistivity is attributed to the fact that a



Pipe welding barge works right ahead of coating barge.

number of valve settings, risers and other fabricated parts had been hand-coated with enamel and concrete. These results compare favorable with Cathodic Protection Service's experience which indicates that actually a line laid under similar conditions with the conventional enamel and concrete coating could hardly be expected to have more than 25,000 ohms per square foot resistance. This confirms Southern Natural's test on one of its 20-in. concrete-coated lines which immediately after construction had a resistivity of 30,000 ohms. A year later the resistivity was found to be 21,000 ohms. No subsequent tests have been made as Hurricane Flossie washed away some of the test leads and anode installations.

Three series or sets of coating equipment are required for a marine pipe laying spread which consists of the dry mix barge, shuttle barges and the barge on which the pipe is coated.

All ingredients, except the emulsified asphalt and the reinforcing glass, are metered and mixed on the dry mix barge. This barge is 110 ft long, 30 ft wide and carries hoppers into which are loaded the sand and/or barite aggregates and the limestone or barite filler. An additional hopper contains the additives consisting of the synthetic rubber compound and powdered asphalt which are premixed in the proper proportions as they are unloaded onto the barge and immediately before entering the storage hopper. These hoppers have sufficient storage capacity for coating 120 joints of 12-in. pipe. The hold of the barge contains compartments having a storage capacity for a five-day supply of asphalt emulsion and fuel oil used in the operation of the heaters and electric power generators.

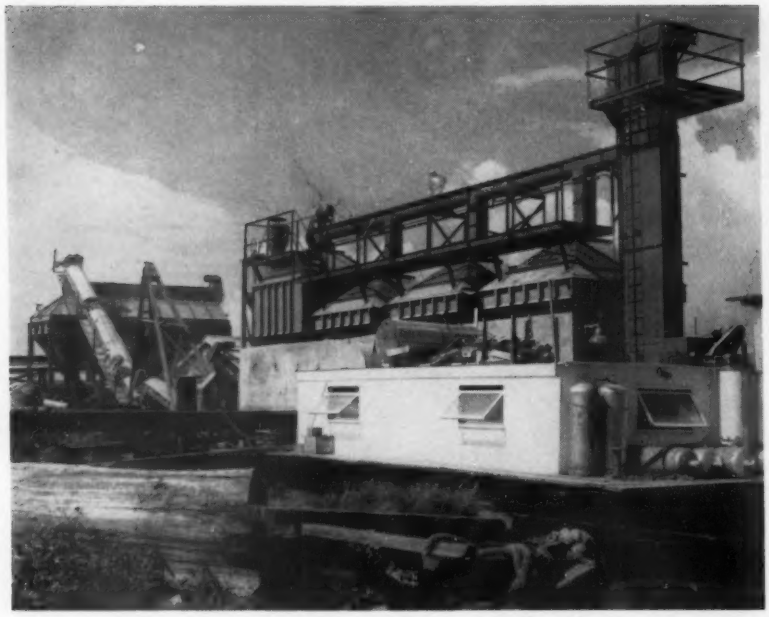
On the dry mix barge all hopper materials are continuously metered by vein feeders onto a conveyor belt which discharges into a continuous paddle type mixer where they are mixed and fed onto another conveyor belt for loading into the shuttle barge. The materials are mixed at a rate which will load a shuttle barge in four hours. The dry mix barge

A view of some of the mixing equipment.

is located at a point accessible to rail, barge or truck shipments for the receiving of materials, and one from which the shuttle barges can readily be dispatched to any part of the construction job.

At least two shuttle barges are required in order to supply the coating barge. Each barge has a nest of deck-mounted hoppers which hold sufficient dry mix for one day's operations. Storage tanks for a day's supply of emulsion and fuel oil are also deck mounted. Each shuttle barge is 110 ft long by 26 ft wide and can be brought up behind and moored to the coating barge, while transferring materials, without interruption of the work.

The coating barge is 110 ft long by 30 ft wide, has hoppers and tank capacity for one day's supply of materials and carries the equipment for hot mixing the materials and applying the coating mixture to the pipe. The coating barge dry mix storage hoppers are filled from the shuttle barge by use of belt conveyors and the emulsified asphalt is pumped into a storage tank on the rear of the welding barge immediately ahead of the coating barge. The dry mixed materials are fed by a bucket elevator from the storage hoppers into a metering hopper from which it is again metered, together with the emulsified asphalt, into a continuous paddle type mixer which discharges into the hot mixing machine. Upon leaving the hot mix machine, the mixture enters a single pug mixer for an additional short mixing period. This mixer is equipped so that it may be either externally heated or cooled in order to bring the material to a temperature which will permit it to enter the coating machine at the desired temperature. The internal glass reinforcement is chopped and fed in during this final mixing process. The material is then conveyed into an insulated surge hopper which has a storage capacity for about six joints of 12-in. pipe. The hot mixture is finally discharged from the surge hopper into a skip hoist bucket type conveyor which elevates the mixture and dumps it into the coating machine hopper from which it is extruded under pressure and vibration about the pipe as the pipe passes through the coating machine. The outer glass reinforcing mesh is spiralled on the pipe under tension as the pipe leaves the coating machine nozzle and immediately thereafter the coated pipe is cooled with water by a telescoping spray type cooling sys-



Dry mix barge loads materials into shuttle barge.

tem that extends from the coating machine to the end of the coating barge. The coating barge is attached to the rear of two 110-ft by 30-ft barges upon which the pipe is aligned, welded, radiographed and heated to about 115° F before it reaches the coating machine. The welded pipe then travels back along the coating barge and through the coating machine where a continuous coating is extruded about the pipe. After leaving the coating barge, the pipe is lowered to bottom by means of a cradle suspended from the rear of the barge.

The coating machine is mounted on a self-propelled car that moves on rails and which also carries a flame dryer and a cleaning machine. This equipment extends over a distance of about 16 ft in which length the pipe is flame-dried, cleaned and coated. The car also carries a hopper for the hot mixture from which it is fed by gravity into the high-pressure extrusion pumps of the coating machine which force the coating on the pipe.

In starting the coating operation, sufficient pipe is welded into a section extending from the welding stations on the welding barges to the coating machine which is filled with the hot coating material and located directly in front of the surge or loading hopper. The coating machine and coating car are then locked to the pipe and, as the barges are pushed ahead, the car and machine are moved toward the rear of the barge for a distance of approximately forty feet, or the length of a double random length of pipe. The shove on the pipe is then stopped and the coating operation started with the coating machine moving under its own power back to its starting position in front of the surge hopper where the coating hopper is again filled for the next coating cycle. The coated pipe is continuously sprayed with cooling water as it travels to the end of the barge over two ferris wheel type of pipe supports. It is then lowered to the bottom by means of the cradle suspended from the rear of the barge. While the coating operation is underway, welding operations are being completed on the pipe ahead in readiness for the next shove. The coating machine is again locked to the pipe and the barges pushed forward the length of a double random length of pipe and the coating cycle repeated. A cycle takes about five minutes, thus allowing the welding, coating and lowering of about 120 joints or 4800 ft of 12.75-in. pipe in a 10-hour work day.

Before completing a report on a subject of this nature, the question of cost is always of paramount interest. The actual cost of coating the first pipeline on which Timcoat was used was comparable with the cost of an enamel and concrete coating including the cost of installing steel reinforced concrete field joints. Subsequent to this job, Southern Natural again advertised for bids on additional pipeline work specifying Timcoat and the bid prices for Timcoat that were furnished the bidding contractors by the Timcoat Co., were in line with the company's past experience for the cost of the customary enamel and concrete coatings.

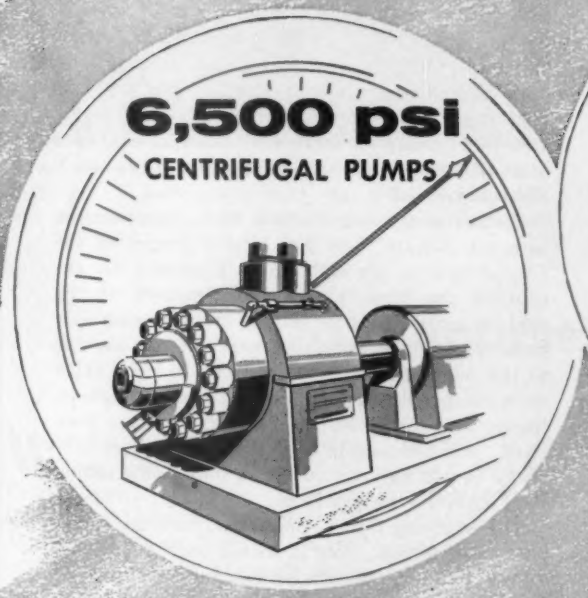
Since the first Timcoat job, the Timcoat Co. has developed new sources of supply for the critical ingredients such as the barite, asphalt and synthetic rubber, at a much lower price than the original price paid for these items. This, coupled with the fact that the laying cost should be less than that for concrete coated pipe, indicates that the overall cost of installing a Timcoated pipeline should be less than a line coated with the conventional enamel and concrete coating.

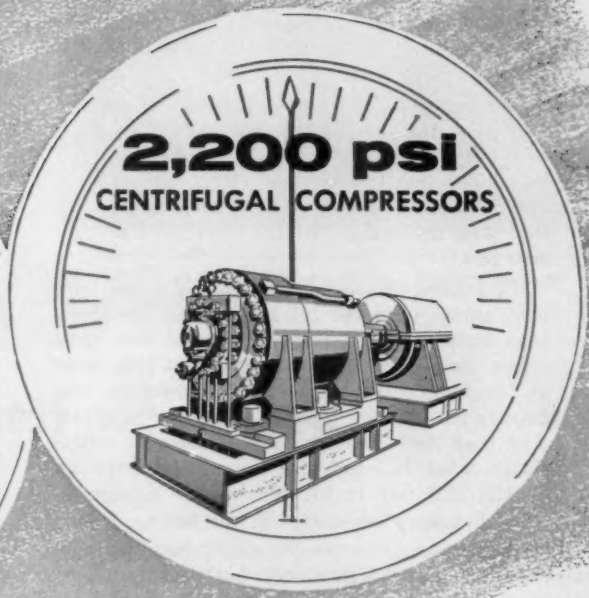
At present the Timcoating equipment is limited to 12.75-in. OD pipe; however, drawings and plans are now in preparation for a machine and attendant equipment to coat pipe up to and including 24-in. OD. Studies and tests are also being made to adapt the mixture and equipment to a yard type operation near the job site in the event it may be necessary or desirable to do so.

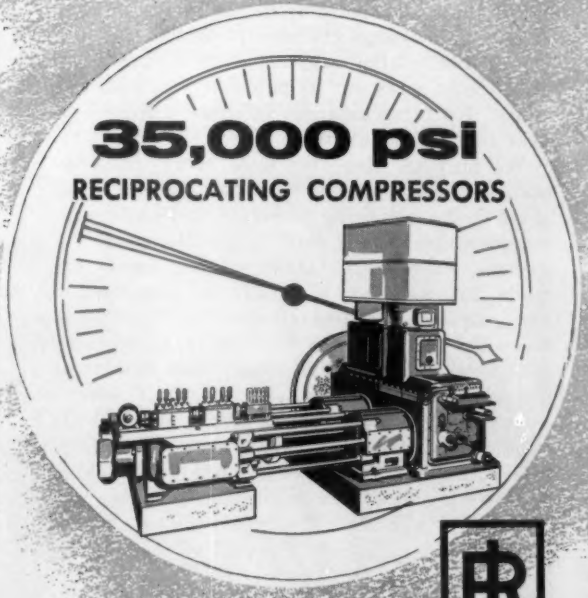
In conclusion it must be said that Timcoat is a new product which necessarily has not had sufficent time to completely prove itself. However, it can be safely said that the management of Southern Natural is thoroughly sold on the coating, and, at the present time, is again laying pipelines on which Timcoat is being used. ■

This article has been adapted from a paper presented by Mr. Brown at the ASME Petroleum Mechanical Engineering Conference, Tulsa, Sept. 22-25, 1957. The paper was titled "Development and Application of High Density Asphalt Mastic Coating."

hi-psi*







These gauges show high levels of gas and liquid pressures created by machines designed and built by Ingersoll-Rand.

Such pressures have not always been practical. Most top levels have crept up little by little as new processes in industry demanded higher and still higher pressures. Those indicated here are bold advances, much higher than the preceding highs. Each is another building block in the foundation of experience.

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* **hi-psi** . . . high pressures, measured in pounds per square inch.

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AN EDITORIAL

THIS "Memphis" decision can hurt all segments of our $20 billion gas industry. True, the Supreme Court of the United States has consented to review the findings of the U. S. Court of Appeals in the District of Columbia and some gas industry experts are confident that the "Memphis" decision will be overturned, but you can't hang your hat on that.

The way gas industry regulation and legislation have been going for the past five years would lead one to a conclusion—based on feeling alone—that the Supreme Court just may not overturn Judge Washington's "Memphis" opinion. And the chances of the Harris-O'Hara bill look bad.

We assume that every employee of a gas company knows what the full meaning of the Memphis decision is. If not, we suggest that they direct their attention to the excellent treatment of the subject in this issue's *Regulatory and Legislative Trends* column, found on page 11. And read Neil Regeimbal's fine, accurate analysis of what is happening to our industry up Capitol Hill way in his *Washington* column in GAS' February issue and in this issue.

The decision in the Memphis case may be exactly right. We think not, but that is for the U. S. Supreme Court to decide. The public interest has been served by the gas pipelines operating under the Natural Gas Act and Section 4 rate procedure, administered by the Federal Power Commission, for the past 18 years. Now, this time honored and proven—not perfect—procedure has been knocked into a cocked hat. We certainly agree with FPC Chairman Jerome K. Kuykendall's statement that ". . . I doubt very much if the Court of Appeals comprehended the magnitude of the result of what it was doing. . . ."

The Memphis case leaves us floundering around in a bottomless morass of inept legislation, inconsistent court decisions and pathetically regrettable political adventures.

Each segment of the gas industry is dependent on the other two.

Pundits tell us pipeline companies may have to refund more than $200 million in revenues collected under rate increases that were put in effect, subject to FPC jurisdiction. That's a lot of money. Colorado Interstate Gas Co. might have to refund nearly $60 million. This is roughly 26 per cent more than their annual income for 1956. It places a possible liability on each share of Colorado Interstate's stock that is about equal to 75 per cent of the market price of its common. This is good for the distribution companies Colorado Interstate serves?

And it doesn't end with this most-extreme example. Nearly every major, long-line transmission company is similarly—though to a lesser degree—situated. If the Supreme Court lets the lower court decision stand, it is going to hurt and it is going to hurt all of us. The insurance companies, investment bankers and stock brokers of Wall Street are not so dumb. They will not care to risk investment capital in a sick industry. Few industries have ever been as confused and frustrated as our gas industry in mid-February.

Section 4, actually Section 4(e), was written into the Natural Gas Act by the people of the United States through their Congress to encourage the financing and construction of the vast long-distance natural gas transmission systems that help bring the benefits of gas service to the public in nearly all states. In good faith with the people and the laws of their Congress, the natural gas pipelines to do this job have been built. Are the people of the United States now going to pull the rug out from under this industrial marvel—the pipelines?

The Supreme Court should overturn the Memphis case opinion. And it should do it as quickly as possible. If this decision stands the test of law in the highest court of our land, then legislation must be enacted from the people through Congress to change the laws so that the natural gas industry—the nation's fifth largest—can function to carry out its public service responsibility. An integrated gas industry will have to take the lead in this work.

We at GAS Magazine urge every gas company employee, and every other person interested in the well being of our country's economy, to closely watch the path of the Memphis case review. Further, the industry must openly explain its position to the public at large and to the Congress. We sincerely feel that by so doing we will be fighting for stability in an industry that supplies the nation with a vast amount of energy at a time when expansion of energy resources is vital. More natural gas will be needed in the coming 20 years than ever before. A healthy gas industry can supply it. But no single segment of the gas industry can supply this energy nor can a single segment or a single gas company walk down this path of crisis alone.

FRANK CHAPMAN
Publisher

J. FRED EBDON
Editor

Under a moss-festooned oak tree in the Louisiana hardwood country, pipe is double jointed (left). Pipe in trench—a wet one, which is characteristic of the area—has been tape-wrapped, and

overwrapped with felt. Crane (right) holds preassembled block valve setting as tie-in welds are run on. Southern Natural's own "spread" did the work.

Do it yourself pipelining

WHEN it needed to lay some new line at its Toca and Franklinton (both in southern Louisiana) compressor stations, Southern Natural Gas Co., Birmingham, moved in a construction department "spread."

One recently completed project that Construction Superintendent Tom Bailey's "spread" did itself involved some 2000 ft of 20-in. OD line. The spread consisted of: three D-7 caterpillar tractors, two equipped with pipelayers; a P&H crane; four welding-generator sets; two water pumps; and the usual line-up clamps, slings, pipe cutters and bevelers.

The scene of this construction was at the Toca station. The pipeline extension is to and from a site where Texas Natural Gasoline Corp. will build a new natural gasoline extraction plant. It ties-in with the Barataria Bay line on the suction side of the compressor station, in the station yard.

The entire project — pipeline, block and side-gate valves, assemblies, blowdown stacks, etc.—was coated with polyethylene tape wrap. The Polyken tape was applied with a 4-in. overlap. Then, an outer wrap of coal-tar saturated pipeline felt was spun on.

All of the construction equipment is owned by Southern Natural and was operated by this integrated pipeline company's personnel. ■

At left water pump chugs away draining the excavation as pipeliners hand wrap, with polyethylene tape, a weld tying-in block valve assembly with line to a new extraction plant. Rain has halted

work (right) on block and side-gate valve setting in the yard at Southern's Toca station. This ground is typical of the area—pretty firm, but always "damp."

GAS • PIPELINE NEWS

Political explosions hit gas bill

A special report from Neil Regeimbal

The natural gas bill was badly damaged in February by political explosions touched off by a Texas Republican fund-raising dinner and a blow-up in a House investigating committee. Most political experts agreed that the bill was in critical condition, but perhaps stood an outside chance of pulling through.

The Texas GOP goof, unusual only in that the reasons for supporting the fund-raising project were put on paper, slapped a political taint once again on the gas and oil industries and their money. It was, some political strategists said, the muddy equal of the 1956 incident involving Sen. Case, which resulted in a Presidential veto of an even stronger gas bill.

Congressional cloakroom talk had the events immediately preceding the explosion figured like this:

The White House had agreed to deliver Republican votes for the gas bill if the Democrats would match them. The total was enough to pass the bill. The Democrats' only hope was coal state votes, and an agreement for an amendment to the bill to bar below-cost industrial sales by gas pipelines had been worked out which would deliver these votes — and probably still will. When the White House, however, began to back away from the agreement, Democrats on the House Commerce Committee decided to put pressure on by unlimbering a full-scale probe of regulatory agencies, leading off with the Federal Communications Commission.

That, the talk goes, brought the White House back in line, and the inquiry then was to simmer down. But a reluctant chief investigator of the committee tried to grab the reins. The Texas disaster weakened the structure, and the whole precarious balance collapsed like a tepee in a tornado.

Both Republic and Democratic gas bill supporters were working desperately in the closing days of February to bring order out of the chaos these developments caused. They were having trouble. Borderline Congressmen of both parties were afraid of the consequences they might face at the polls in November if they lined up for the gas bill. Republicans particularly were gun shy, even though the so-called "tainted money" had been refused by their party.

A lot would depend, the shell-shocked gas bill supporters admitted, on what position President Eisenhower took, both publicly and privately. Immediately after the two political bombs burst in quick order, Rep. Oren Harris, sponsor of the gas bill, and other gas industry "freedom fighters," were clinging to the protection of their offices and refusing comment until the answers became clearer.

The marshlands of Cameron Parish, La., made conventional trench digging methods impossible, so United Gas Co. engineers equipped this Cleveland trencher with special pontoons to dig a pipeline from Deep Lake to Lake Charles. The amphibious Cleveland, hooked up with a Marsh Buggy to aid forward movement, did a good job of digging its way through the swamplands despite the fact that shallow water covered much of the right-of-way for the 6-in. connecting line.

Quicker action on Canada's gas export anticipated

Canadian government officials are now indicating they may move more quickly than originally expected to clear up the gas export question.

Most Washington sources are predicting that the new Conservative government will eventually honor promises of previous Liberal party officials to permit Midwestern Gas Transmission Co., and its parent Tennessee Gas Transmission, to pipe 200 MMcf of gas per day across the border into the central area of this country.

Earlier indications that the newly appointed Royal Commission on energy resources would delay a decision on the Midwestern proposal until all energy supplies had been studied have been eased.

Conservative Prime Minister John Diefenbaker on two occasions in January told inquiring members of the Canadian House of Commons that "I am hopeful" and that it is "my desire and that of the government" that the study commission make an interim report, and that the commission has been told such a report "is expected."

While the Midwestern project was not mentioned by name, many observers believe that such an interim report will make recommendations for at least a temporary export arrangement with the would-be U. S. importers of Canadian gas.

Witnesses plead producer cause in FPC hearings

The public interest, which is committed to the care of the FPC, is not "solely the interest of today's consumer of natural gas," Dr. Henry Herz, a Washington consulting economist, said when he

Now, lay coated pipe without special handling

ABOVE: 16-inch pipe being spray-coated for use in new Transcontinental Gas Pipe Line Corp. gas-gathering system near Tilden, Texas.

Save up to 20 per cent in laying costs on large-diameter pipelines. Spray—coat pipe with Copon Arocoat before installation. Then, haul it, stack it, bend it and lay it with little more care than you would use for bare pipe. Tough Copon Arocoat coatings will survive these operations without chipping or cracking, and Copon Arocoat can be applied to welds with an ordinary paint brush.

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testified before the FPC recently.

"It is also the interest of future consumers who are concerned with conservation of scarce fuel reserves, and of producers, who must be treated fairly if a safe, adequate and convenient supply is to be forthcoming," he said.

Dr. Herz is a witness before the FPC hearings in which nine independent gas producers are attempting to prove that producers prices cannot be computed on the same basis as are the rates of pipelines and other utilities.

"Fortunately," Dr. Herz continued, "the interest of consumers, producers, transporters, and distributors, and the public interest in conservation, are complementary. The interests of present and future consumers and of producers and the intermediate handlers of natural gas are complementary, in the sense that the needs of each are dependent upon the continued economic health of all the others."

Gas producers involved in the hearing are Champlin Oil & Refining Co., Pan American Petroleum Corp., Continental Oil Co., Western Natural Gas Co., Atlantic Refining Co., Humble Oil & Refining Co., Sinclair Oil & Gas Co., Tidewater Oil Co., and C. V. Lyman.

The hearing took an unexpected turn when agreement was reached that testimony by one witness could be read into the record. The witness was Paul Grady, a partner in the New York public accounting firm of Price, Waterhouse & Co.

Grady's testimony outlined reasons why the sales realization method of splitting joint cost of producing oil and gas should not be used in determining the cost of gas.

"This method is totally unsuitable for the purpose," he said. "This does not involve cost determination at all, but rather a splitting of overall profit or loss between gas and oil."

"It seems to me," he added, "this effectively extends regulation to oil, which I believe is clearly contrary to present law."

The last witness to appear in person was L. Emery Katzenbach, a partner in the New York investment banking firm of White, Weld & Co.

"The rate of return earned by a company on its investment capital," he testified, "determines the funds it will have available to service its debt and preferred stock and to pay dividends to stockholders. It follows that if a company is permitted an overall rate of return on its invested capital equal to that of other companies exposed to similar risks, it will be in a position (a) to attract the funds it needs for growth and expansion on a competitive basis; (b) to provide equity holders a return on their investment comparable to that obtainable in other ventures exposed to comparable risks; and (c) to preserve its credit and financial integrity."

Price superintendents win new safety honors

H. C. Price Co., Bartlesville, Okla., again has been accorded top honors by the Pipe Line Contractors Association for its record of safety in pipeline construction.

All five of Price's spread superintendents and Nelson VerSoy, Gulf Coast manager of the Pipe Coating division, were presented certificates for the outstanding safety records achieved by the construction units under their direction.

The superintendents are G. A. Reutzel, W. H. Olrich, R. L. Ezell, C. R. Ice, and Clarence Shivel.

Tennessee Gas acquiring California rocket firm

Nearing completion are the plans of Tennessee Gas Transmission Co. to acquire Grand Central Rocket Co., developer of the third-stage Vanguard rocket motor.

According to Charles R. Bartley, president of the Redlands, Calif. rocket company, the move will make greater financial resources available for research and development.

Grand Central also developed an Army antitank missile and an Air Force hypersonic test vehicle which achieved seven times the speed of sound in two seconds. It also developed the third and fourth stages of the Air Force Farside project in which a rocket was sent 4000 miles into outer space over the Pacific.

Northern moves to get expansion under way

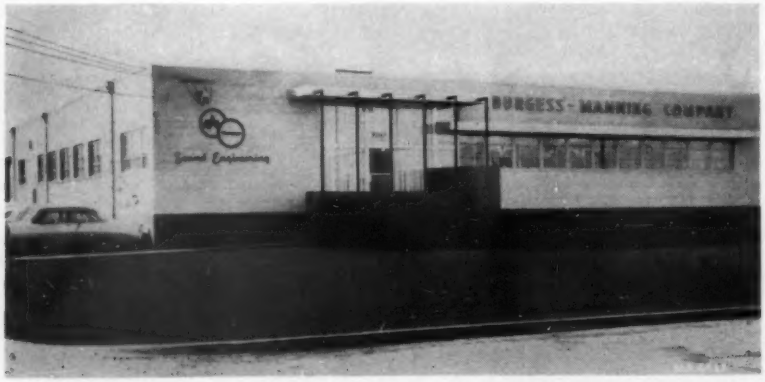
In an attempt to get current expansion moving, Northern Natural Gas Co., Omaha, filed an $86 million proposal with the FPC.

The newest filing, Docket G-14218, supplements the facilities and service covered in Docket G-12241 (the 1957 expansion program).

Last August, Northern got a temporary okay from the commission on some non-competitive portions of G-12241 involving 46.6 MMcf/day and service to old customers. Then in November, the company moved to sever the non-competitive portions of G-12241, which would add 36 MMcf/day deliveries to 134 non-competitive towns.

The latest move is a two-year construction program consisting of 221 miles of 24- to 30-in. mainline loops, 232 miles of 12- to 16-in. line, and added compression of 32,000 hp.

Main part of the supply—100 MMcf/day — would come from Northern's subsidiary, Permin Ba-



Burgess-Manning's industrial silencer division has just moved into its new modern plant in the Brookhollow industrial district of Dallas. Featured in the new structure is an air conditioned development lab in which studies can be made of field problems relating to noise, flow of gas in pipes, and liquid separation.

Along the new highways . . .
ROSKOTE DOES THE JOB WITH SPEED!

Fast drying that permits overcoating or wrapping in a half hour steps up the protective coating phase of new pipeline construction on the jobs where speed is essential — along the nation's new network of highways.

A good example is this 8000 foot stretch of new 8" pipe along the new Southside Expressway in downtown Charleston, W. Va. It was installed recently for the United Fuel Gas Company by Saul and McCallister, Inc., of Yawkey, W. Va.

This contractor found that two men, using the Roskoter for application of Roskote 612 XM cold-applied pipe mastic, could keep pace nicely with the welders. The coating specifications called for over-the-ditch cleaning, two 15 mil applications of Roskote 30 minutes apart, followed immediately by wrapping with 15 lb. perforated asbestos pipeline felt.

Roskote 612XM is a cold-applied, fast-drying pipe mastic of high electrical resistivity. Composed of high grade native pyrobitumens homogenized with quality aromatic solvents and inhibitive pigments, Roskote is also highly resistant to corrosion by acid, alkali and salt. It dries to a tack-free film in 30 minutes or less. It is unaffected by temperature from sub-zero to 250°F. It will not oxidize, scale or check, and it bonds readily to previous coats of Roskote, coal tar or asphalt.

Non-toxic and non-irritant, Roskote may be applied by brush, glove, spray or Roskoter. The latter is seen in use in the photograph.

The Roskoter, one of the simplest means of coating pipe known, is also the most effective. It actually "bathes" the pipe in mastic as an extra safeguard against pinholes and other coating irregularities. And it gets the undersurface and other hard-to-see spots, often missed. Coating with the Roskoter can usually be handled by one man.

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A welder caused us to caucus

The note from an employee suggestion box read "How come a company like this hasn't got the U. S. Savings Bond Payroll Savings Plan". It was signed by a welder in the fabricating department.

Since we actually *do* have Payroll Savings this told us two things: (1) Probably more employees than we imagined wanted the advantage of buying U. S. Bonds automatically through Payroll Savings. (2) We had grown lax in bringing our Plan to their attention.

But what to do? The solution was simplicity itself.

We called in our State Savings Bonds Director. He provided all the promotional materials needed to arouse interest in U. S. Savings Bonds. Then he helped to conduct a personal canvass and place an application blank in everyone's hands.

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GAS MAGAZINE

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The recently completed Kingston to Albany pipeline of Central Hudson Gas and Electric Corporation conquered many challenges presented by 48 miles of rugged terrain—snaked its way over mountains and even scaled a 300 ft. cliff. Construction supervision and inspection services were supplied by United Engineers.

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pipeline news • *Cont'd.*

sin Pipeline Co. In a companion filing (Docket G-14219), Permin seeks facilities costing $543,000 to boost its deliveries to Northern from 375 MMcf/day to 475.

The rest of the new supply would come from the Redfield storage field and miscellaneous sources. Service proposed would give newly served communities second year additional requirements of 37.3 MMcf/day.

New service to 177 communities in Minnesota, Wisconsin, the Dakotas, Iowa, Nebraska and Illinois would be 77.3 MMcf/day for the first year and 35.9 for the second year.

United Gas Pipe Line plans two-phase program

United Gas Pipe Line Co., Shreveport, plans to build about 203 miles of 30-in. line paralleling its existing line between New Orleans and Mobile, Ala.

In its application (Docket G-131-42), United said the construction is needed so the company can continue to supply requirements of its present customers in the Mobile-Pensacola area and along the route of the New Orleans-Mobile line. Estimated cost of construction: $33.7 million.

The project would consist of two phases. The first includes 78.7 miles of line from New Orleans to Hancock county, Miss. and 38 miles from Harrison county, Miss. to Jackson county, Miss. The second phase would include 86 miles of pipeline paralleling sections of the company's southeast Louisiana-Mobile line.

Expansion job progresses

With the stretch-reducing mill in full operation, the first phase of Lone Star Steel Co.'s $8 million expansion program is completed. Other phases of the expansion program include a reinforcing bar mill and a fifth open hearth furnace.

The new mill was designed and built by the Mannesmann-Meer Engineering & Construction Co. in Dusseldorf, Germany. The complete mill was erected in Germany and given a thorough testing before it was dismantled and shipped to Lone Star's Dallas headquarters.

Continued on page 156

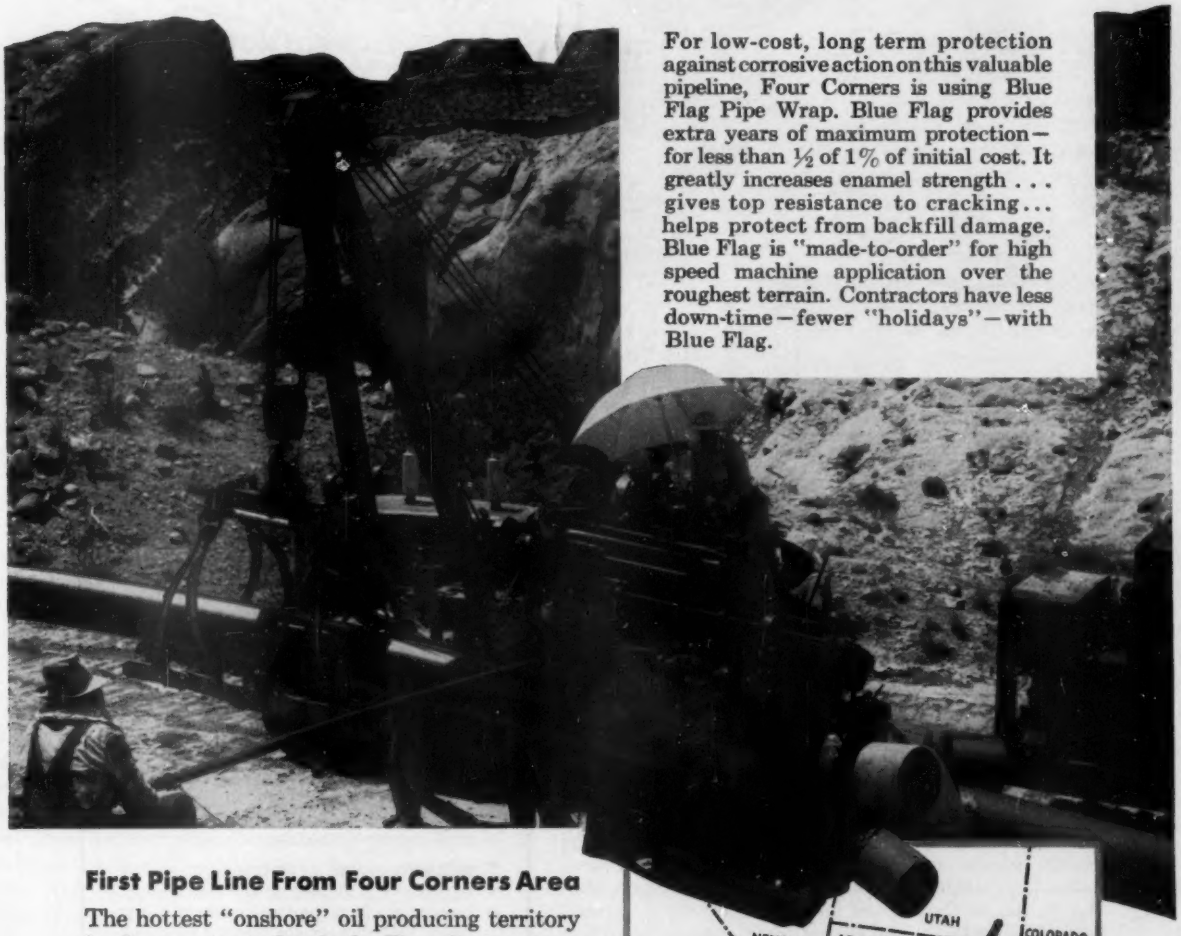
BLUE FLAG

PIPE WRAP PROTECTS

50 Million Dollar Four Corners Pipeline

THROUGH TOUGH SOUTHWEST TERRAIN

Long-lasting protection on over 573 miles of 16" pipe



For low-cost, long term protection against corrosive action on this valuable pipeline, Four Corners is using Blue Flag Pipe Wrap. Blue Flag provides extra years of maximum protection—for less than ½ of 1% of initial cost. It greatly increases enamel strength . . . gives top resistance to cracking . . . helps protect from backfill damage. Blue Flag is "made-to-order" for high speed machine application over the roughest terrain. Contractors have less down-time—fewer "holidays"—with Blue Flag.

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The hottest "onshore" oil producing territory in the country today is the Four Corners area of Utah, Colorado, New Mexico and Arizona. This prolific area is being tapped by a mammoth pipeline extending all the way to Los Angeles. Owned by six major oil companies, Four Corners Pipeline will mutually benefit oil producers in the field and the oil purchasing companies in Southern California.

For technical data on applications such as this Four Corners job, write L·O·F Glass Fibers Company, Toledo, Ohio. Dept. 74-38.

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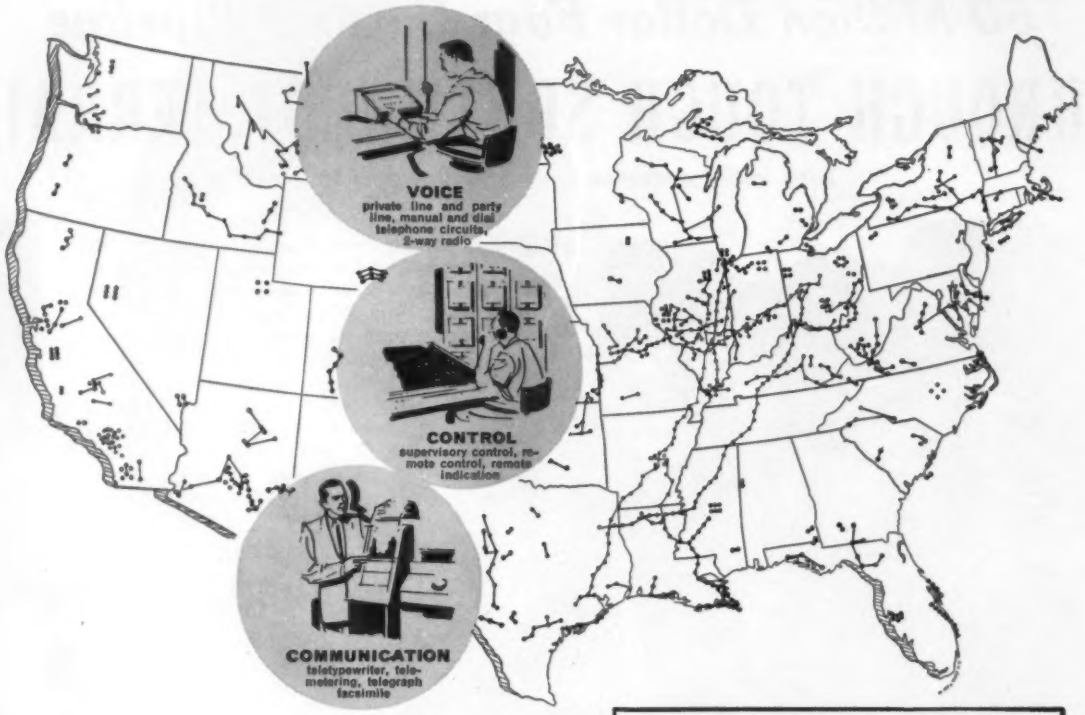
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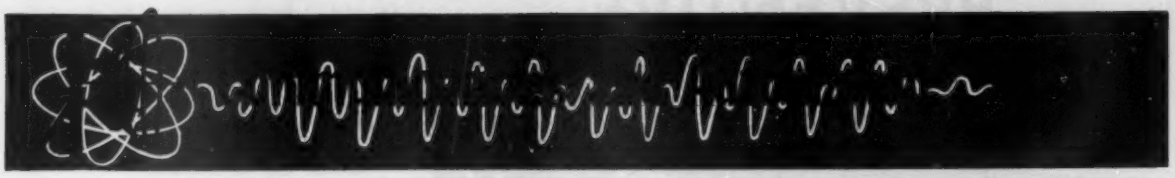


Edited by FRANK CHAPMAN

Communications role in pipeline automation

By F. VINTON LONG

ZERO communications are required at a truly automatic compressor or pump station. Such a station is self-contained and by means of intelligence obtained from its load or flow will take steps to adjust itself accordingly.

However, such an individual station is usually only half of the whole, the whole in this case being a pipeline.

Control of this pipeline does require communications and they must be good.

By that we mean sufficient channels and built-in reliability.

Such adequate communication is not for free but if it means the difference between ultimate efficiency of the pipeline system and something less than that, plain economics will force its use.

Voice communication is only a small part of the control of a pipeline; telecontrol of compressors, gas purchases, and gas deliveries are required, and continuous feedback intelligence is a necessity to maintain optimum pack and flow.

Computers will take over the slow and tedious business of constantly receiving large quantities of line condition data, digesting it, and issuing the proper instructions for operation of the line.

Automatic pipeline operation requires constant communication facilities, and such facilities are extremely difficult to obtain. Privately owned plant, such as microwave, can be designed to provide the constant service required, provided that sufficiently rugged equipment is installed and alternate routing of communication channels is used, such as dual transmitters and other devices. It is very difficult to provide full physical separation of alternate facilities on long-haul, privately owned communication links, and in this respect the common carrier long-line suppliers have a definite advantage.

On the other hand, the common carriers may find it economically impractical to provide strong construction and alternate routing on links connecting their long line routes and the sites of the pipeline pumping stations involved. And in this respect privately owned microwave or other types of communication equipment many times will provide more reliable service. I refer particularly to remote and inaccessible sites where much open wire line work would be required.

There is no clearcut general advantage of either leased or privately owned systems. Both are good, and determination of the method used should result from an exacting study on a case-by-case basis.

This problem of adequate communications to enable the use of tele-control of pipelines is serious business and may mean the success or failure of the whole pipeline operation.

It is difficult for management to conceive the fact that it is often easier to purchase and lay a pipeline and install compressor stations than it is to obtain really reliable communications in the same length of time.

One of the major companies right now is faced with the problem that it may have its new pipeline expansion completed before adequate communication for safe telecontrol operation is available. Fortunately, the management is cognizant of the facts and is facing up to the situation.

Apparently it is the duty of communication and telecontrol engineers to pound into management's ears again and again the fact that without safe communications you do not have safe control and without safe control, management had better stick to manual operation.

And, the evaluation of what is safe and unsafe complete control of automatic pipeline operation should not be left to the sales personnel of communication companies, private or common carriers. Telecontrol engineers have the responsibility to convey to management the facts concerning each proposed installation. Management, on the other hand, has the responsibility to heed the advice of its engineers treading in a heretofore unknown field.

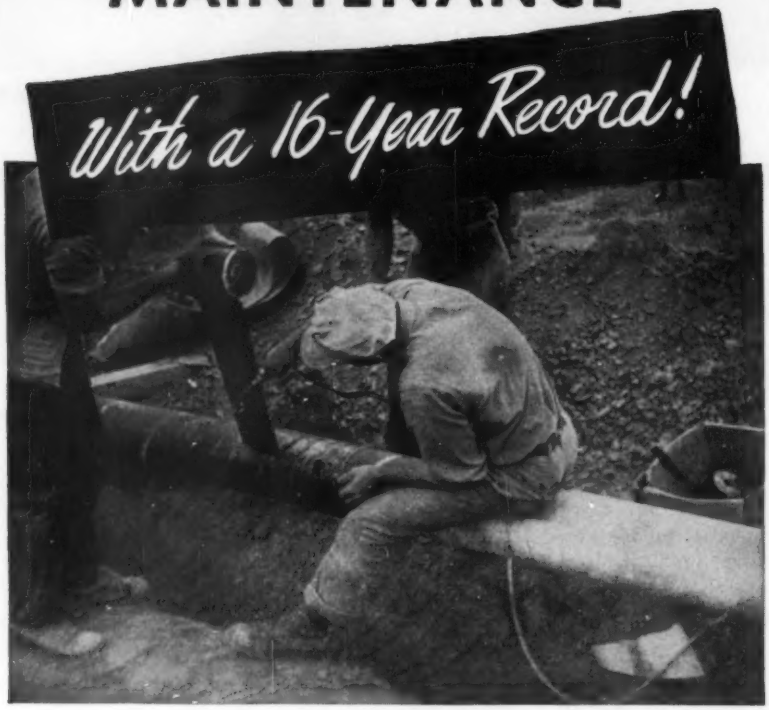
I really do not think that pipeline executives realize that their entire automatic pipeline operation can collapse and fall on its face unless adequate communications are in use.

I believe that each pipeline executive when presented with a communication proposal for telecontrol of his line should ask the question: "Do you, the supplier, think sufficiently high of your proffered communication links to assume the responsibility of delivering our gas (or crude, or products), to our customers on schedule?"

If the answer is no, management should ask for reasons why the supplier might not trust continuity of service of his own facility. This question should be carefully asked of each supplier of communication equipment.

If the supplier cannot provide such ironclad insurance of continuous and reliable operation, then management must assume the risk

PREVENTIVE MAINTENANCE



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and it behooves them to place the best and most loyal engineers available on the job because it is only a matter of time before a poorly engineered job will fall by the wayside as far as operating profits are concerned.

What I am saying is that it is possible to provide communications that will stay put, and at that time and not before will full automatic pipeline operation become a reality.

Investment of $2 million in a compressor station is a poor risk if the station is not adequately controlled. And absolute control means more than starting and stopping the station. It means exacting measurement of flow and station efficiency and transmission of this intelligence to the controller.

It means constant supervision of compressor speed, if variable, surge or pressure conditions if centrifugal compressors are used, temperatures, and other operating variables. And the instructions the controller provides must be received without fail by the controlled station. If by unattended operation of a pump or compressor station you decrease efficiency or increase downtime, you had better forget the whole thing and retain attended, manual operation.

Another thing to avoid, if you do decide on telecontrol, is not to skimp on channel space. You cannot obtain something for nothing and you cannot obtain the flexibility of operation from a "cheap" or 15-cycle channel that is provided by a more expensive voice quality circuit. Oftentimes it is not required but when it is, management should remember that the investment in good control facilities is the cheapest part of pipeline operation and if the pipeline does not wish to go "first class," it had better leave telecontrol and the art of pipeline cybernetics alone.

But the pipelines have always gone "first class" in everything that they have done and it is only through good management that the lines have earned the respect of the public and the investors and the complete loyalty of their employees.

These pipeliners are a breed all their own and when the problems of telecontrol of their line and use of the art of cybernetics comes up, I am not afraid. ■

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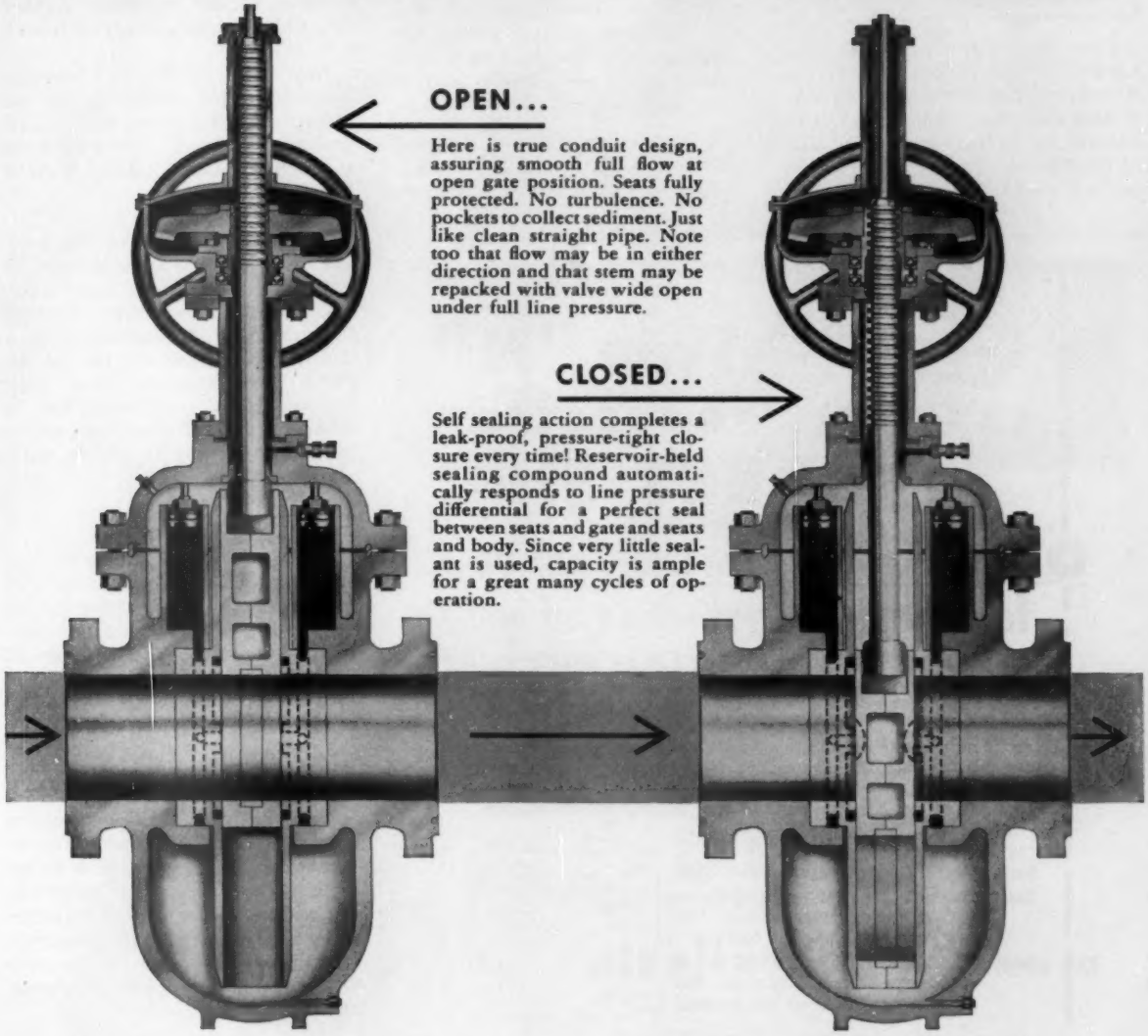

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from page 150)

GAS • Pipeline Notes

Lone Star Gas Co., Dallas, has applied to the FPC for authority to construct an 880-hp compressor station and other facilities to store natural gas in the Ambassador field of Clay county, Texas. The $740,000 job will enable Lone Star to service its present customers in Wichita Falls and other local distribution systems in the area more efficiently.

Arkansas Louisiana Gas Co., Shreveport, wants to spend up to $2.2 million (Docket G-13328) for new facilities during 1958. The additions will enable Ark La to connect more gas supplies and to make sales to industrial customers.

A basic contract has been signed by El Paso Natural Gas Products Co. and Rexall Drug Co. to convert styrene produced at El Paso's new Odessa plant into a primary material used in making plastics. Under the agreement, El Paso will supply styrene to Seamco Chemical Co., a division of the Seamless Rubber Co., which is a subsidiary of Rexall.

Rep. Byrd (D-W. Va.) has introduced a bill providing for an import duty of 5 cents/Mcf on natural gas. The measure was referred to the House Committee on Ways & Means.

Black, Sivalls & Bryson Inc., Kansas City, Mo., has been licensed to build and sell oilfield lease automation systems under patents held by the Shell Development Co., a subsidiary of Shell Oil Co. In addition, arrangements have been completed for the transmittal to BS&B all of Shell's technical information pertaining to oilfield automation systems.

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Sturdily built and precision engineered, Good-All "Type N" rectifiers provide essential corrosion "insurance" for well coated systems, and are an absolute necessity for poorly coated systems. Small concentration of earth currents prevents interference on foreign piping. No heavy equipment needed for installation.

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MODEL	VOLTS OUTPUT	AMPS OUTPUT	D-C OUTPUT STEPS
N 18-3	18	3	11
N 18-6	18	6	11
N 24-10	24	10	18
N 36-6	36	6	18
N 36-10	36	10	18

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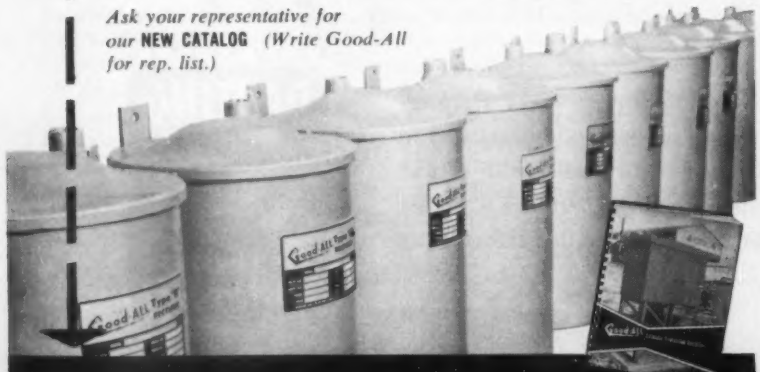

GOOD-ALL ELECTRIC MFG. CO.
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The FPC recently:

Okayed the 1958 portion of New York State Natural Gas Corp.'s $7 million expansion plan (Docket G-9138). The Pittsburgh-based company will replace 56.5 miles of 20-in. line from Tioga county, Pa. to Ithaca, N. Y. with 30-in. line over a four-year period. Plans also call for installation of 2000 hp at the Boom compressor station.

Gave the go-ahead to Northern Natural Gas Co. (Docket G13116) to spend about $5.5 million to attach new gas supplies. According to the Omaha company, the supplies are available from several relatively small producing areas located close to its system in Texas, Oklahoma, and Kansas.

Told American Louisiana Pipe Line Co. to go ahead with its $1.4 million plan to connect additional gas supplies in Louisiana (Docket G-11510, et al). American Louisiana will build about 7.3 miles of 16-in. and 4.8 miles of 12-in. line to connect North Holly Beach field and Second Bayou field in Cameron parish with its existing facilities.

Authorized the $2.6 million plan of United Gas Pipe Line Co., Shreveport, calling for new facilities in Terrebonne parish, Louisiana (Docket G-13114). United Gas will install about 13 miles of 16-in. from its lateral line in the Kent Bayou field to a point in the Halter

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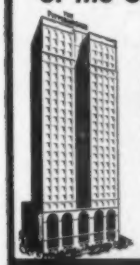

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AMherst 4-5152

Joseph F. Duddy, Gen. Mgr.

SHOTT IK HOTELS

pipeline news • *Cont'd.*

Island Field area. Also, 17.4 miles of 8-in. lateral supply lines, meter stations, and other facilities needed to take additional deliveries from wells in the area.

Okayed Atlantic Seaboard Corp.'s $2.4 million project in West Virginia and Virginia (Docket G-116-73). The Charleston-based company will build about 5 miles of 26-in. loops in Hardy and Grant counties, W. Va.; install an additional 2000-hp unit at its Cleveland compressor station in Upshur county, W. Va., a 2000-hp unit at its Files Creek station in Randolph county, and an 880-hp unit at its Huff Creek compressor station in Wyoming county, W. Va.

Granted Gulf Interstate Gas Co., Houston, permission (Docket G-13647) to spend $51 million in Louisiana, Mississippi, Tennessee, and Kentucky. The Houston-based company will build 351 miles of 30-in. mainline loops and 54 miles of 24-in. lateral loops. Gulf Interstate says the additional facilities will boost its maximum winter delivery capacity to 666.1 MMcf/day.

Authorized Permian Basin Pipeline Co., Omaha, to acquire, construct and operate gas facilities in Andrews county, Texas at an estimated cost of $897,400 (Docket G-13023). Permian will buy an existing 1350-hp compressor unit in Andrews county from Phillips Petroleum and will turbocharge six of the 12 units presently operating at Andrews.

Green-lighted Texas Eastern Transmission Corp. and Wilcox Trend Gathering System's plans to spend $4 million for facilities that will enable the companies to take into their systems gas which will be purchased from producers close to their existing transmission systems (Dockets G-13391 and 13392).

Okayed Northern Natural Co.'s $3 million looping plan. The company proposes to construct about 18 miles of 30-in. line in the Oklahoma panhandle and 9 miles of 30-in. in the Texas panhandle.

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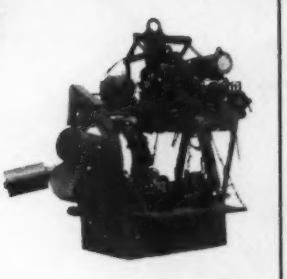

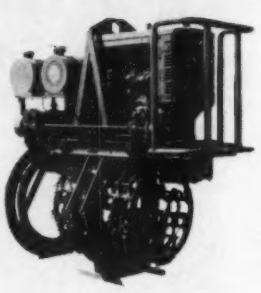

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Pipe prefabrication simplifies construction problem

Located at a scenic and rugged mountainous section of West Virginia, the Sweeney Compressor Station presented many construction problems for Hope Natural Gas Company's engineers.

Fabrication of heavy-walled carbon steel pipe at the site proved impractical. Weight of the pipe alone made it too costly and time consuming. However, working to close tolerances, Dravo prefabricated the pipe in its shops at Marietta. Field assembly required a minimum of welds with most sections simply being bolted together.

Prefabrication of piping to rigid specifications is one of the many Dravo services to industry. For information on this or any products listed below, write to DRAVO CORPORATION, PITTSBURGH 25, PA.

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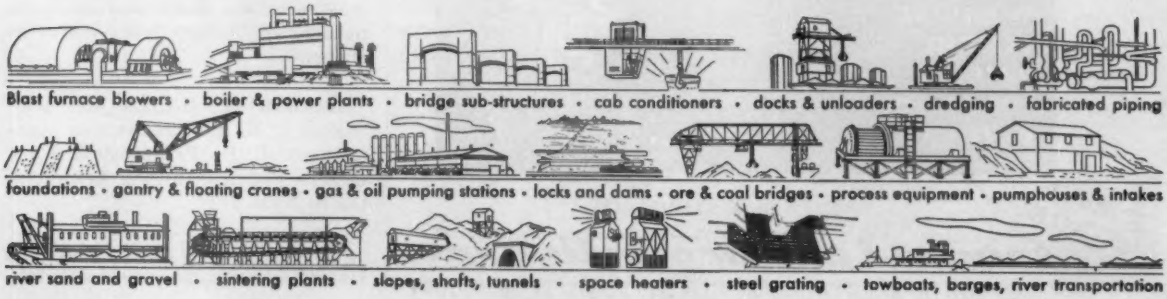
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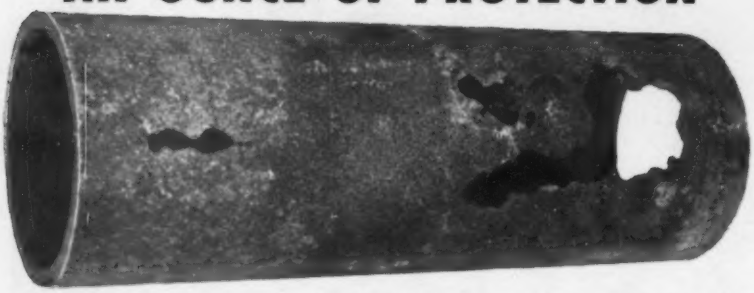

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Steel Grit Cleaned	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1	Primer	Primer	Primer	Primer	Primer	Primer	Primer
2	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel	2/32" Enamel
3	1/32" Enamel	Glass	Glass	1/32" Enamel	1/32" Enamel	1/32" Enamel	1/32" Enamel
4	Asbestos Felt	1/32" Enamel	1/32" Enamel	Asbestos Felt	Glass	Asbestos Felt	Glass
5	Kraft	Kraft	Asbestos Felt	X or Seal Coat Enamel	X or Seal Coat Enamel	X or Seal Coat Enamel	X or Seal Coat Enamel
6	.....	.....	Kraft	Kraft	Kraft	Asbestos Felt	Asbestos Felt
7	.....	.....	.....	.....	.....	Kraft	Kraft

These specifications available in any type of enamel or asphalt

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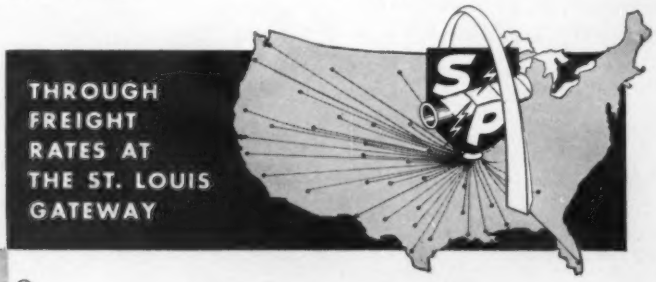

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GAS Pipeline People

Three officers of Northern Natural Gas Co., Omaha, have been promoted to the posts of senior vice presidents. The men and their areas of responsibility are: A. B. DILWORTH, policy matters relating to increased earnings per share for stockholders and decreased costs of gas to consumers; M. L. MEAD, policy matters concerned with research and diversification; and LARRY SHOMAKER, broad top level policy and executive areas of public relations and associated fields. Mr.

A. B. Dilworth
Northern

M. L. Mead
Northern

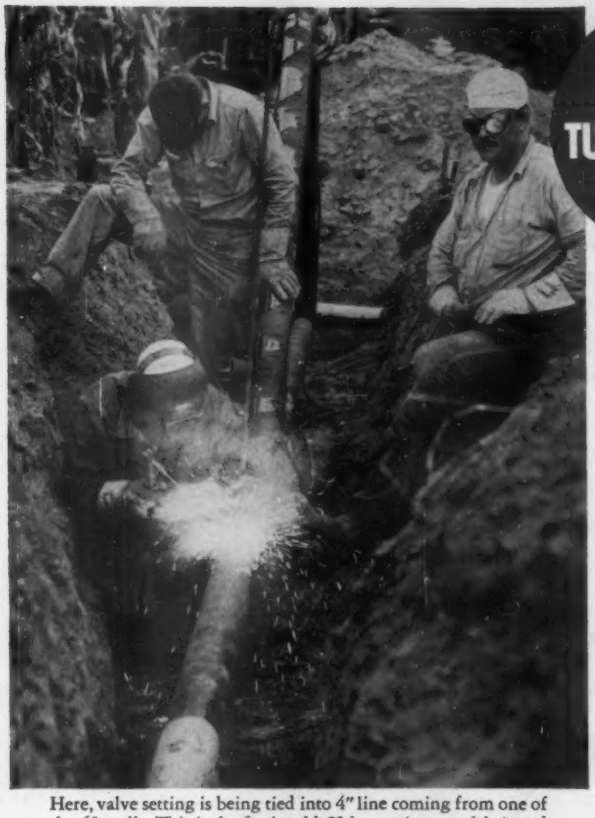
Larry Shomaker
Northern

Randolph Buck
Northern

Dilworth has been a vice president since 1948, Mr. Shomaker since 1950 and Mr. Mead since 1952. J. RANDOLPH BUCK has joined Northern Natural as senior reserves engineer in the reserves and availability section of the gas supply department. Before joining Northern, Mr. Buck was an independent petroleum consultant in Dallas.

KENNTH G. HOLDEN has succeeded A. B. MCCLELLAND as manager of J. F. Pritchard & Co.'s eastern district. He will headquarter in New York.

Tennessee Gas Transmission Co., Houston, has made several appoint-



TUBE-TURN

Valve settings call for *perfect fit-up*

says Ohio Fuel Gas Company

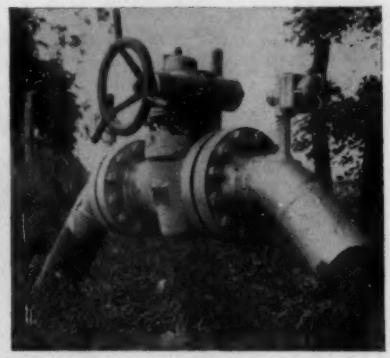
Here, valve setting is being tied into 4" line coming from one of the 63 wells. This is the final weld. Valve setting was fabricated at the site from 4" pipe and four TUBE-TURN* 45° Elbows. TUBE-TURN Fittings are known everywhere for their unsurpassed uniformity for perfect fit-up.

Construction of valve settings is a good test for the skill of pipeliners . . . and the close tolerances of their pipe fittings! And a good proving grounds was a project of Ohio Fuel Gas Company in connecting 63 storage wells to their Pavonia Pumping Station near Mansfield. The pictures tell the story.

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

Welding section with 6" x 4" TUBE-TURN Reducing Tee into 6" gathering line. Joints were cut and bevelled with bevelling machine to assure accurate fit-up of pipe.

Completed tie-in of valve setting into 6" gathering line. This line connects into 12" main to Pavonia Pumping Station. Bottom member of valve setting serves only as a brace.



Completed valve setting in gathering line. This shows two TUBE-TURN 45° Elbows and Welding Neck Flanges. All pipe and fittings are Schedule 40.

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ments involving oil and gas exploration and production activities. R. S. RANDERSON JR. is production department coordinator. Named as petroleum engineer for TGT's wholly owned subsidiary, Chaco Petroleum S. A., was MORRIS E. KITTLESON. He will headquarter in Cochabamba, Bolivia. J. H. HUDGEONS, formerly district production clerk at Hobbs, N. M., for Tennessee Gas, has been assigned to Cochabamba as office manager for Chaco. Office manager for TGT's overseas department in Houston is H. G. IRWIN JR.

WILSON N. GILLIAT has been promoted to assistant vice president—engineering of Williams Brothers Co. He is succeeded as chief engineer by CHARLES J. FLINT, formerly assistant chief engineer. Mr. Gilliat, who joined Williams in 1954 as project engineer, has been chief engineer since 1956. Mr. Flint joined the company in 1955.

RICHARD P. GIFFORD has been named manager of engineering for General Electric Co.'s communication products department in Syracuse, N. Y. He succeeds C. M. HEIDEN, who has joined the G-E Research Laboratory at Schenectady, N. Y.

FRANK RAMSEY has been appointed manager of Texas Gas Transmission Corp.'s Wilmot (Ark.) compressor station. He replaces GEORGE F. MOSBY, who retired. Most recently Mr. Ramsey was assistant manager of the Texas Gas compressor station at Lake Cormorant, Miss.

John McIntosh
CPS

JOHN C. MCINTOSH has joined the staff of Cathodic Protection Service, Houston. As sales manager of the company's newly formed Protective Coating division, Mr. McIntosh will direct the full-scale development program in the protective coatings field.

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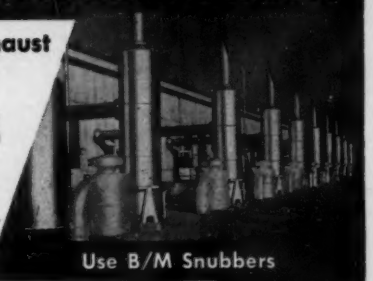

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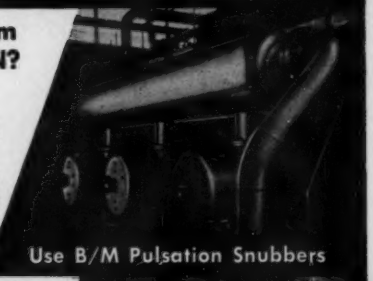
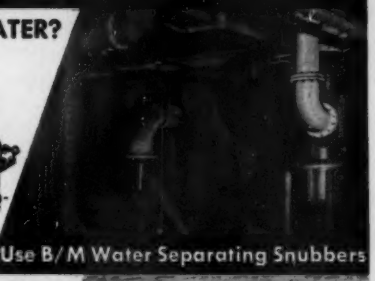


Use B/M Pulsation Snubbers

EXHAUST WATER?



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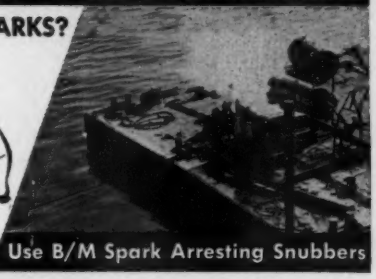
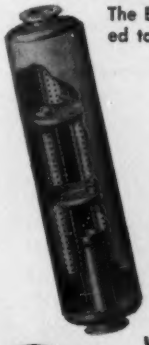


Use B/M Spark Arresting Snubbers



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CARL C. WHITAKER has been promoted to superintendent of operations for Trans-Canada Pipe Lines Ltd. He will headquarter in Toronto. Mr. Whitaker joined Trans-Canada in 1956 and served as construction supervisor.

Recent promotions at Kaiser Steel include RALPH W. CUTLER to manager of engineering and estimating at the Montebello (Calif.) fabricating division plant; A. L. COLLIN to chief development engineer at the same plant; and JAMES A. MAGGETTI to assistant plant manager at Kaiser's Napa (Calif.) plant.

J. B. STOREY has been elected a director of Union Producing Co., production subsidiary of United Gas. Before his tranfer to Shreveport, Mr. Storey was manager of the New Orleans district of United Gas Pipe Line and Union Producing. R. C. BRYAN, assistant manager of the New Orleans district since 1956, succeeds Mr. Storey as district manager.

ROBERT L. BREEDLOVE has been promoted to chief geologist for Arkansas Louisiana Gas Co., Shreveport. Mr. Breedlove, who has been acting chief geologist since early last year, has been with Ark La's geological department since July 1935.

ROY W. P. JOHNSON and CURT J. HAVEKOTTE have been promoted to assistant New York district manager and New York branch manager, respectively, by Cooper-Bessemer Corp., Mt. Vernon, Ohio. Mr. Johnson will work with District Manager C. M. Reagle in the development of broader sales markets and Mr. Havekotte will supervise the domestic New York office staff and sales force in direct sales contact. Cooper-Bessemer also has announced the appointment of WOODROW W. WALIGORE to the Odessa (Texas) branch office. Mr. Waligore will work as a sales engineer.

GEORGE STEVEN has been appointed assistant general manager of the compressor and engine division of Worthington Corp., Buffalo, N. Y.

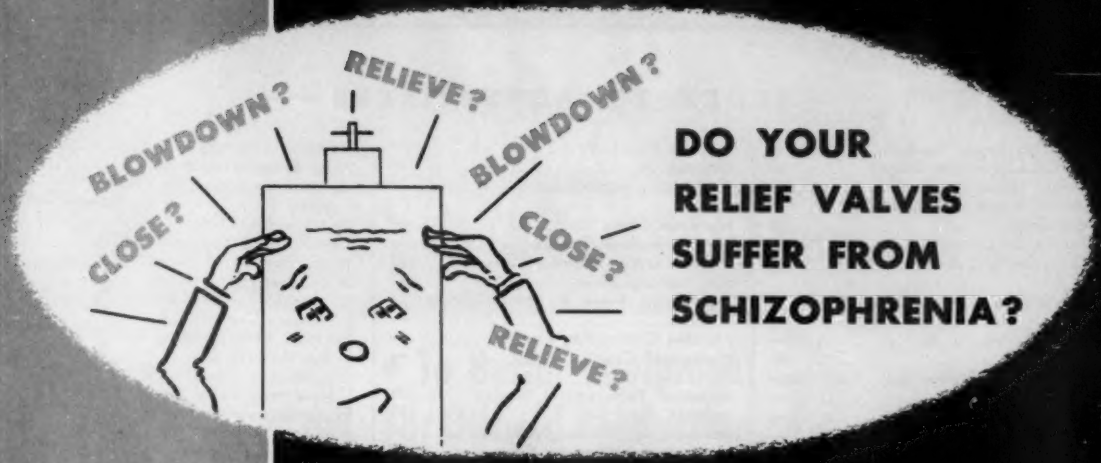
JOSEPH M. TEMPLE has been appointed manager of a new sales region set up in the Rocky Mountain area by the Foxboro (Mass.) Co. From headquarters in Denver, Mr. Temple will supervise Foxboro offices in Denver, Salt Lake City, Kansas City and Omaha. These offices formerly were administered through the Chicago regional office. Working out of the new Denver branch office as sales engineer is PAUL C. JONES.

JOSEPH NALLE has been elected vice president and petroleum engineer of Texas National Bank of Houston.

EDGAR I. CROWLEY and JOHN R. WEINERT have joined the research and development department of Pittsburgh (Pa.) Coke & Chemical Co. Mr. Crowley is in the engineering development section as a senior chemical engineer while Mr. Weinert will be a senior chemist in the R&D laboratory's protective coatings section.

E. I. Crowley
Pittsburgh Coke

John Weinert
Pittsburgh Coke



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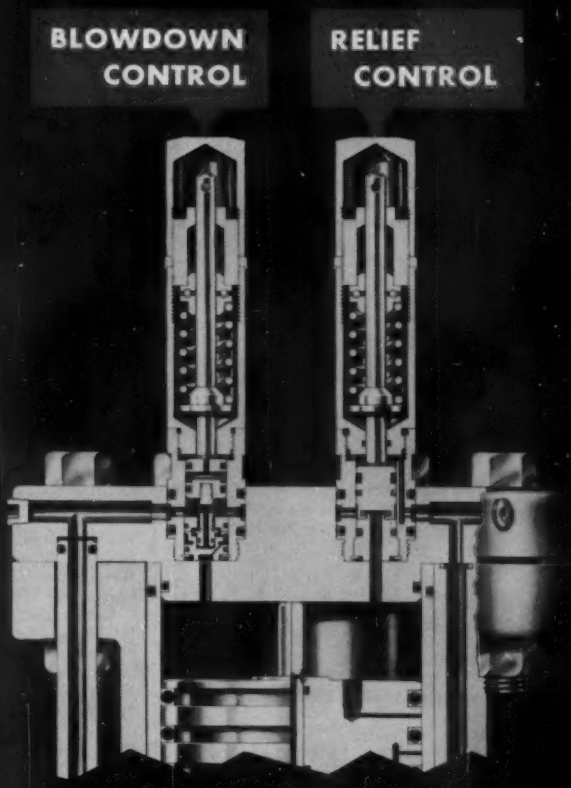
This complete division of functions gives a decisive action to the Garrett Relief Valve . . . action that assures utmost accuracy and the ultimate in protection. For complete information on this and other features of Garrett Relief Valves, write for Bulletin No. RV-103.



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— INDEX TO ADVERTISERS —

Adams Pipe Repair Products 94
American Liquid Gas Corp. ..... —
American Meter Co. 54, 111
American Radiator & Standard Sanitary Corp. 53
American Recording Chart Co. 115
Aqua Survey & Instrument Co. 102

Barber-Greene Co. 14
Baso Inc. 93
Beaird Co., Inc., J. B. ..... —
Bilco Co. 94
Black, Sivalls & Bryson, Inc. ..... Third Cover
Blaw-Knox Co. ..... —
Bonney Forge & Tool Works ..... —
Bristol Co. ..... —
Browne Mfg. Co. Inc., Stewart R. 112
Bucyrus-Erie Co. ..... —
Builders Providence Inc., Div. of B-I-F Industries, Inc. ..... —
Burgess-Manning 163
Busada Manufacturing Co. 104

Cast Iron Pipe Research Assn. 28, 29
Cathodic Protection Service 164
Chaplin-Fulton Mfg. Co. 22
Cleveland Trencher Co. 91
Conkey & Co., H. D., Field Control Div. ..... —
Connelly, Inc. ..... —
Cooper-Bessemer Corp. 137
Copon Associates 145
Coppus Engineering Corp. 51
Cosa Corp. 104
Crane Co. ..... —
Crose Mfg. Co., M. J. 158

Darling Valve & Manufacturing Co. 155
Dearborn Chemical Co. 43
Diebold Inc. ..... —
Dollinger Corp. 49
Dow Chemical Co. ..... —
Drake & Townsend Inc. ..... —
Dravo Corp. 159
Dresser Industries, Inc. ..... —
Clark Bros. Co. 148-149
Dresser Manufacturing Div. 44
Roots-Connersville Blower Div. 95
Southwestern Industrial Electronics Div. ..... —
Duriron Co., Inc. ..... —

Eastman Chemical Products 32
Ebasco Services, Inc. ..... —
Eclipse Fuel Engineering Co. ..... —
Edwards Inc., Allan 162
E-I-M Co., Inc. ..... —
Electro Rust-Proofing Corp. ..... —

Falcon Line Products Corp. 106
Field Control Div., H D Conkey & Co. ..... —
Fish Engineering Corp. ..... —
Fisher Governor Co. 24 25
Fisher Research Laboratory, Inc. 114
Foster Co., L. B. 16
Foxboro Co. ..... —

Garrett Oil Tools, Inc. 165
Gas Equipment Manufacturers Committee ..... —
GAS Subscription Order 107
General Controls ..... —
Good-All Electric Mfg. Co. 156
Goodrich Chemical Co., B. F. 46
Grabler Manufacturing Co. 5
Grayson Controls Div., Robertshaw-Fulton Controls Co. 7
Greenlee Tool Co. ..... —
Griffiths Co., E. F. ..... —
Grinnell Co. ..... —
Gulf States Asphalt Co. 12

Hardwick Stove Co. ..... —
Hays Manufacturing Co. ..... —
Heath Survey Consultants Inc. 103
Hill, Hubbell & Co. 50
Homestead Valve & Manufacturing Co. ..... —
Houston Contracting Co. ..... —
Hydrauger Corp. ..... —

Industrial Polychemical Service 109
Ingersoll Rand Co. 141
International Business Machines ..... —
International Harvester Co. 30

Jaeger Machine Co. 40, 41
Johnson-Williams, Inc. ..... —
Jones & Laughlin Steel Corp. ..... —
Joslyn Mfg. and Supply Co. 31

Kaiser Steel Corp. ..... —
Kitson Valve Div. Welsbach Corp. ..... —
Koenig Iron Works Inc. ..... —
Kraloy Plastic Pipe Co., Inc. 88

Lancaster Meter Parts Co. 107
Lascopipe Inc. 113
Ladeen Manufacturing Co. 4
Librascope Inc. 108
L.O.F. Glass Fibers Co. 151
Lone Star Steel Co. 3

Maloney Co., F. H. 150
Mannesmann-Easton Plastic Products Co. Inc. 52
Mayor-Kelly Co. 162
Maxim Silencer Co. ..... —
Maxitrol Co. 33, 34
May Products Inc. 114
Mine Safety Appliances Co. ..... —
Minnesota Mining & Mfg. Co. ..... —
Motorola Communications & Electronics, Inc. 152
Mueller Co. 26

National Tank Co. 118
National Tube Div., U. S. Steel Corp. 48
Natural Gas Odorizing Inc. 42
Naugatuck Chemical Div., U. S. Rubber Co. 20, 21
Nordberg Manufacturing Co. ..... —
Nordstrom Valve Div., Rockwell Manufacturing Co. 13
Norton-McMurray Manufacturing Co. 105
Norwalk Valve Co. ..... —

Ohio Injector Co. ..... —
Onan & Sons Inc., D. W. 110
Oronite Chemical Co. 9

Parkhill Truck Co. ..... —
Parsons Co. 89
Peerless Manufacturing Co. 38
Peerless Mfg. Div., Dover Corp. ..... —
Pennsalt Chemicals Corp., Ind. Div. ..... —
Perfex Plastics Inc. 109
Perrault Equipment Co. ..... —
Philadelphia Gear Works Inc. ..... —
Pipeline Coating & Engineering Co. ..... —
Pipe Line Service Corp. ..... —
Pipe Protection Service Inc. 110
Pittsburgh Coke & Chemical Co. ..... —
Pittsburgher Hotel 158
Polyken Products Div., Kendall Co. 18
Protecto-Wrap Co. ..... —

Radiator Specialty Co. 112
Reed Manufacturing Co. ..... —
Reliance Regulator Div., American Meter Co. ..... Second Cover
Republic Steel Corp. 36, 37
Reynolds Gas Regulator Co. 92
Ridge Tool Co. ..... —
River Construction Corp. ..... —
Robertshaw-Fulton Controls Co., Grayson Controls Div. 7
Rockwell Manufacturing Co. Gas Products Div. ..... Front Cover
Instrument Div. ..... —
Nordstrom Valve Div. 7
Roots-Connersville Blower Div., Dresser Industries, Inc. 95
Royal McBee Corp. 45
Royston Laboratories Inc. 147

Safety Gas Main Stopper Co. 115
Security Valve Corp. ..... —
Sinclair Oil & Gas Co. ..... —
Skinner Co., M. B. 35
Smith Corp., A. O. ..... —
Smith Manufacturing Co., A. P. ..... —
Somerville Construction Co. ..... —
Southern Cross Foresters 102
Southern Mill & Manufacturing Co. ..... —
Southern Pipe & Casing Co. ..... —
Southwestern Industrial Electronics Div. ..... —
Southwestern Plastic Pipe Co. 108
Sprague Meter Co. ..... Fourth Cover
Stafford Co., R. W. 114
Standard Electric Time Co. ..... —
Standard Magnesium Corp. 1
Standard Pipeprotection, Inc. 160
Superior Meter Co. 47

Tapecoat Co. 154
Taylor Forge & Pipe Works 128, 129
Tennessee Gas Transmission Co. ..... —
Tex-Tube Inc. 39
Thermac Co. 23
Transcontinental Gas Pipe Line Corp. ..... —
Tube Turns Inc. 161

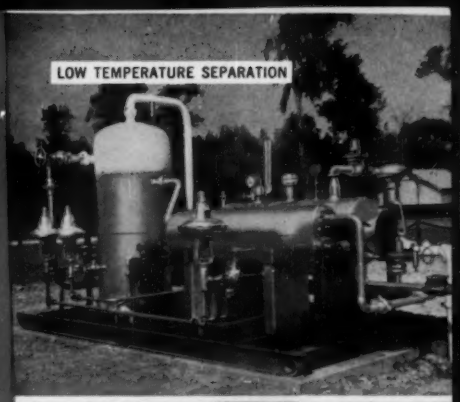
Union Carbide Corp., Union Carbide Chemicals Co. ..... —
Union Malleable Mfg. Co. ..... —
United Engineers & Constructors 149
United Pipe Line Contractors Inc. ..... —
U. S. Pipe & Foundry Co. 27
U. S. Rubber Co., Naugatuck Chemical Div. 20, 21
U. S. Steel Corp., National Tube Div. 48
Universal Chemicals Corp. 105
Universal Controls Corp. 114

Vermeer Manufacturing Co. ..... —
Vulcan Rubber Products, Inc. 106

Warren Petroleum Corp. 114
Webster Engineering Co. 90
Welsbach Corp. Kitson Valve Div. ..... —
Williams Pressure Service Co. ..... —
Williamson, Inc., T. D. 116
W-K-M Div., ACF Industries 157
Wood Co., John 111

Youngstown Sheet & Tube Co. 133

Zippertubing Co. 112



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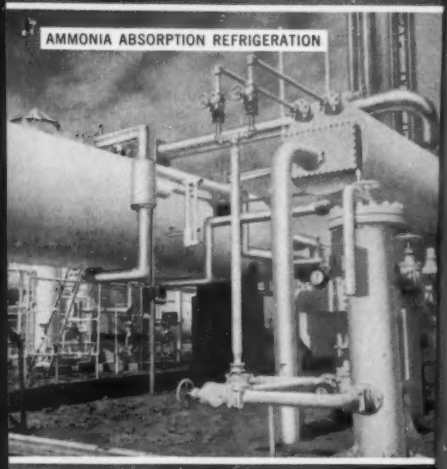

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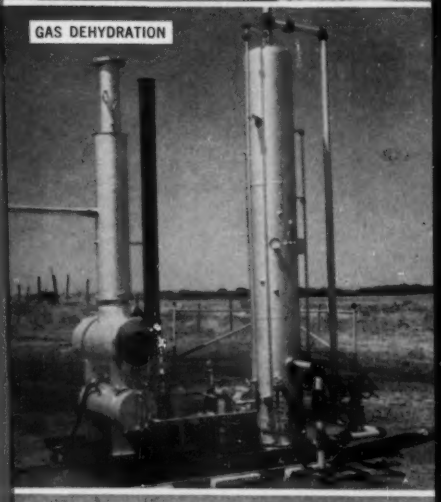

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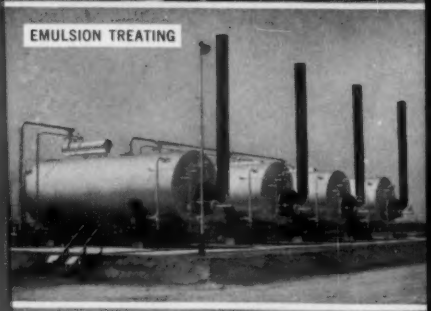

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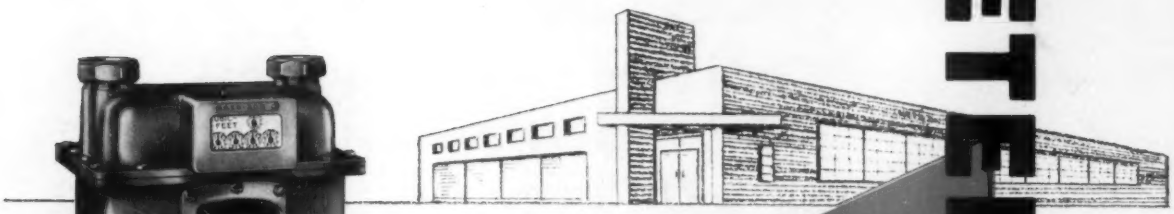

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